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PAUL PRESSLY McCAIN: 1884-1946

It is a deeply appreciated honor to have a part in the publication of this issue of the NORTH CAROLINA MEDICAL JOURNAL which, one year after his death, is dedicated to the memory of Paul McCain, the "Beloved Physician" of our commonwealth.

Paul McCain's life was devoted to furthering the welfare of tuberculous individuals in North Carolina. A South Carolinian by birth, he strove throughout his whole professional life for the advancement of the tuberculous in that "valley of humiliation" situated between two mountains of conceit (so stated), Virginia and South Carolina. Renouncing his birthright as a native of one of the two mountains (both of which we all greatly respect), Paul McCain did more for the prevention and cure of tuberculosis in the Old North State than any other individual ever has, and he did it by means of a triad of qualities that is rarely found in one man.

He was gifted to be an excellent clinician, always abreast of what was newest and best, and an outstanding executive, who was able to harmonize and correlate the work first of one, then of two, finally of three sanatoria, widely scattered, that eventually came under his supervision and control. Perhaps best of all, he was a good politician who could get, or almost get, what he wanted for his institutions and his patients—*never* for himself, let it be stressed—from the "Powers that Be" in Raleigh. He accomplished this last feat simply by the frank simplicity of his personality, by his transparent sincerity and honesty, by the obviously moderate demands that he made, and by his revealing proofs of their necessity—for others! Paul McCain was no man to go self-seeking!

He did not have an easy time down the years. He had many struggles, in most of which he triumphed. I think that his chief weapon was the use of a verse from the Bible: "A soft answer turneth away wrath." Of this he was a past master. I know that he was often angry with that "righteous indignation" which Jesus Christ condoned and which, on occasion, He exercised. I never knew Paul McCain to fly into a temper, to use unwelcome words, to lay himself open to any accusation of seeking more for his cause than he felt was justified and justifiable.

Of his own personality it is a bit difficult for me to write, for I loved him very dearly and sincerely, and his death has robbed me of one of my deepest friendships. And the way of his going seemed so vain, so useless,

so futile, to us of finite minds! But some day we will know the answer!

No man in North Carolina was more beloved by people, patients, and colleagues than was Paul McCain. His smile, his gentle approach, the complete unselfishness of the man were apparent at a first meeting; and, which is more to be wondered at, that first impression was never dispelled. How many times have I heard patients say: "Dr. McCain said this"; "Dr. McCain said that"; or "I went to see Dr. McCain and I felt so much better after my visit." This man had those twin gifts of the true physician—the Science and the Art of Medicine. The first is vital indeed, and the second is essential if one is to devote one's life to the treatment of patients whose disease lasts from three to twenty years; indeed, sometimes I think that the Art of Medicine is almost more important than the Science in the management of chronic illness.

I know that Paul McCain had his reverses, his fights, his vicissitudes. I do not know the details thereof—he was never a man to bemoan his troubles; he took them on the chin and dismissed them as far as others were concerned with his disarming smile—but I know that he had them and met them quietly and heroically. I succeeded him as president of the Medical Society of the State of North Carolina. It was a very pleasant duty, as the incoming president, to present to him the President's Jewel. I cannot better end this brief tribute to the memory of my dear friend than by quoting the words I said to him on that occasion, selecting a passage from the Greek poet Bacchylides:

Countless are the high qualities of heroes,
But one there is, set on high, far transcending all,
His it is who, in whatever work his hand finds to do,
Steers his course with righteousness of heart.

PAUL H. RINGER, M.D.
Asheville

I did not know Dr. McCain well. One did not have to know him; you felt him. What is this supreme quality that just a few human beings possess? Upon what does it depend? Does it permit analysis? If it did permit analysis it would not exist. This rare quality of a living being that goes on and on after death, that touches one gently in moments of wrath and harsh judgment, that urges one onward for purposes of worthwhileness, that serves as a solace in failure, does not depend upon this characteristic or that characteristic; like God it is. This strength of calmness, this poise in the tumult, this honesty as a way of life.

WM. DEB. MACNIDER, M.D.
Chapel Hill

"Doctor McCain was a man of unusual ability, enthusiasm, inquisitive mind, and great intellect coupled with a sincere desire to render altruistic service to his fellowmen. He occupied a very high place in the esteem of those who worked with him and knew him well.

"His stewardship as superintendent of the state's tuberculosis hospitals and the great interest he manifested in his patients over many years was responsible primarily for a great reduction in mortality and morbidity rates from tuberculosis in the state of North Carolina. That his people were acutely conscious of his great contributions is attested by the fact that he was signally honored by his profession and his state a number of times.

"As a public-spirited citizen, he was always willing and anxious to help with any program which seemed to be for the best interests of his people. It was on a mission of service to his profession and his state that the catastrophe came which ended his career.

"A devoted husband and father; a kind, generous, and understanding friend; a Christian gentleman has gone from among us. To have known and been associated with him was a benediction. The world is better as a result of his having passed this way. We shall not soon forget him. The results of his splendid service to humanity and the influence of his inspiring personality and life will live on."

—From a resolution written by Dr. Fred C. Hubbard and adopted by the North Carolina Medical Care Commission.

PAUL PRESSLY MCCAIN, M.D.
June 26, 1884 — November 25, 1946

TUBERCULOSIS IN THE SOUTHERN STATES

JULIUS L. WILSON, M.D.

NEW ORLEANS, LOUISIANA

The distinguishing features of the southern area of the United States are climatic, ethnologic, and economic. The higher mean annual temperature, the biracial population, and the predominantly agricultural economy are factors which might be expected to influence the incidence and course of tuberculosis in this area. Even more than elsewhere, another element has been decisive on the Southern front of the long war between *homo sapiens* and the Mycobacterium tuberculosis. That is the men furnishing the generalship—the application of intelligence and energy to the strategy of fighting tuberculosis in these states.

Influence of Climate

There was a time in the first half of the nineteenth century when physicians advised their consumptive patients to move to a warmer climate. It was generally believed that cold weather and moisture acted as an initial cause of pulmonary disorders, including tuberculosis. In 1850 Daniel Drake published his classic and monumental work, "Principal Diseases of the Interior Valley of North America," a pioneer study of diseases considered geographically and statistically. From records kept at army posts and the mortality rates of various cities, Drake concluded that there was "no evidence in support of the current opinion concerning the origin of a tubercular diathesis from cold and moisture." On the contrary, he urged consumptive persons from the Southern states to seek a colder climate in summer, to take voyages to Minnesota ("now a settled region"), and to go to the mountains of North Carolina. At the same time he stated that climate had been overestimated as a factor in the production of tuberculous disease. He observed very acutely that the deficient diet on some plantations seemed to promote tuberculosis, and also that the presence of malaria might be a factor in the greater mortality from tuberculosis in the South than in the North.

From the Departments of Medicine, Tulane University School of Medicine and the Ochsner Clinic, New Orleans, Louisiana.

Seventy years later, when it was an accepted medical opinion that a northern climate and higher altitudes were more suitable for the treatment of tuberculosis than such regions as the southern seacoast, Bushnell[1] wrote: "Northern cities are more favorable for longevity than southern cities, but the climate has little if anything to do with the comparative mortality from pulmonary tuberculosis in large cities."

With the establishment of sanatoriums for the treatment of tuberculosis in every part of the South, it has become apparent that patients recover equally well from this disease in every climate and at every altitude within this area. This finding confirms the opinions of Drake and Bushnell that other factors are much more important than climate in any difference in morbidity and mortality figures which may exist between the various sections of the United States.

The Negro and Tuberculosis in the South

The fact that two races live side by side in the Southern states affects the problem of tuberculosis in this area chiefly because the Negro component of the population (approximately nine million) has a much higher death rate from tuberculosis than that in the country as a whole. Therefore, their high mortality rate raises the total death rate for tuberculosis in this region. However, it would be erroneous to conclude hastily (1) that the Negro has always been more susceptible to tuberculosis than the white person, (2) that this segment of the population accounts at present for all the difference in tuberculosis mortality rates between Northern and Southern states, or (3) that the incidence of tuberculosis is actually greater in Negroes than in white people.

There is statistical evidence that prior to 1862 the mortality rates from tuberculosis were practically the same for white people and Negroes in the South. Jones[2], citing the records of the city of Charleston, South Carolina, from 1822 to 1900, showed that it was only after the Civil War suddenly freed the Negro and removed his economic shelter that such tremendous tuberculosis mortality rates as 675 deaths per 100,000 appeared. At present the mortality rate from tubercu-

1. Bushnell, G. E.: Study in the Epidemiology of Tuberculosis, with Especial Reference to Tuberculosis of the Tropics and of the Negro Race, New York, William Wood & Co., 1922.
2. Jones, T. J., cited by Bushnell (1).

losis for Negroes in the South is declining steadily. The explanation for the fact that their rate is still twice that of the white population is not relevant to this discussion. As has been stated by McCain[3], it is probable that a number of factors cause this difference.

It is commonly believed that the higher death rate from tuberculosis in the Southern states is due entirely to the high mortality rate in Negroes. A comparative study of the figures for white and Negro deaths in Northern and Southern cities or states shows at once that the mortality rate from this disease is greater among white citizens in the South than among those in the North, whereas the reverse is true of the Negro. Generally speaking, the Negro mortality from tuberculosis increases from south to north, whereas the white mortality rate decreases as one goes in the same direction. In the Northern states the Negro death rate is more than five times that of the white population; in the South their rate is less than three times that of the white, and is declining more rapidly. Consequently, we cannot ascribe our greater incidence of this disease directly to the non-white element of the population. As this biracial problem becomes a national one because of the migration of Negroes to all parts of the country, it is even more apparent that its effects on tuberculosis are indirect. The racial problem has held the Southern states back economically rather than by furnishing an uneradicable focus of infection.

Surveys of the population have repeatedly shown that the incidence of demonstrable pulmonary tuberculosis is lower among Negroes than among white people of the same age, sex, and general economic status[4]. Therefore, the Negro population contributes less than its share of cases of tuberculosis in the Southern states, although its mortality rate is higher because of the shorter duration of life after tuberculosis is contracted. By the same token, the spread of tuberculosis (outside of the immediate family) is not maintained to the same extent by Negroes as it is by the more numerous and more chronic cases of tuberculosis among white people. In general, it may be stated that the Negro component of the population is the victim of poverty and disease rather than the cause of the continued prevalence of tuberculosis in this area.

The Effects of a Crippled Economy

The major problem of the Southern states for the past eighty-two years has been economic. Agriculture in the South has never recovered from the major operation of the Civil War. This fact, together with the difficulties of transition to a balance between agricultural and industrial development, has played a major role in the cause of tuberculosis and in the obstacles to the control of this disease. Widespread malnutrition, infestation with parasites, malaria, and venereal disease have resulted directly or indirectly from poverty to prepare the soil in millions of bodies for the seed of tuberculosis. Lack of education, poor sanitation, inadequate health departments—all stemming from the paucity of state income through taxation—have in turn hampered any control measures. The South had been poverty stricken so long that many of its states developed an attitude akin to self-pity, by which all deficiencies in sanitation and education were excused as due to the lack of funds, even long after a measure of prosperity came to planter, mill owner, and the state treasury. These states were lacking both the means to attack tuberculosis and the necessary faith in the present and future to do so. Were it not for certain farsighted individuals and their leadership, the South might be much further behind in the race to conquer tuberculosis than it now is.

Influence of Individuals

After travelling through the South in the 1840's, Daniel Drake[5] wrote: "The consumptives of Florida and Alabama who may not be able to wander far from home have a good resource in the beautiful Valley of the French Broad, Buncombe County, North Carolina, where at an elevation of more than 2000 feet they can enjoy the comparatively cool and invigorating influence of a climate, which I was assured by its physicians, is but little infested with consumption." Thus, long before Trudeau made the Adirondacks a resort for the tuberculous, the doctors of Bun-

3. McCain, P. P.: Tuberculosis among Negroes in the United States, Am. Rev. Tuberc. 35:25-35 (Jan.) 1937.
4. Edwards, H. R.: Tuberculosis Case-Finding: Studies in Mass Surveys, Am. Rev. Tuberc. (supp.) 41:3-159 (June) 1940.
5. Drake, D.: Principal Diseases of the Interior Valley of North America, Philadelphia, Lippincott, Grambo & Co., 1854, 2nd series, p. 901.

combe County, North Carolina, started the reputation of that locality as a place for the cure of tuberculosis! Chaille[6] of New Orleans visited Asheville and wrote articles in medical journals extolling the benefits to invalids of residence among those mountains. In 1875 Gleitsmann opened in Asheville the first sanatorium for tuberculosis in the United States. Although he did not continue this institution for many years, there has followed him in the same city an unbroken line of skilled physicians including von Ruck, Minor, and Ringer.

When the full meaning of Koch's discovery of the tubercle bacillus was realized by gradually widening circles of the medical profession, the attack upon this disease became something more than the treatment of a few well-to-do patients. The first half of the twentieth century has seen both treatment and control measures extended to the masses of the population, where tuberculosis had long ranked as the first cause of death. In 1903 George Brown of Atlanta was a founder and first secretary of the American Congress for the Prevention of Consumption, one of two rival organizations which were the direct cause for the formation of the National Tuberculosis Association in the following year. At the organizational meeting of the National Association in Baltimore there were present, in addition to Osler, Welch and other local physicians, C.L. Minor of Asheville, T. E. Oertel of Atlanta, and M. M. Smith of Texas. City and state tuberculosis associations were founded all over the South between 1904 and 1917 through the leadership of such men as these, with the support of a few laymen who had become interested through personal contact with the disease.

As if in response to a demand, men appeared in various states who were not only good physicians and administrators but who were also able to carry the need of the people for tuberculosis facilities directly to the state legislature until funds were appropriated. To mention only a few of these, special credit must go to L. B. McBrayer and Paul P. McCain from the progressive state of North Carolina. Still among us are Drs. Henry Boswell of Mississippi, J. B. McKnight, of Texas, J. D. Riley of Arkansas, P. A. Turner and E. G. Murray of Kentucky, V. F. Cullen of Maryland, and R. D. Thompson of Florida.

These physicians and others whose names are still honored locally became the leaven in the lump of ignorance, indifference, and parsimony toward tuberculosis in the Southern states. The organization of sanatoriums, clinics and societies, the training of hundreds of younger physicians, and the untiring education of the medical profession, state officials, patients, and the general public became their life work. With less financial resources than in most of the Northern states and with more poverty and malnutrition to foster tuberculosis among their fellow citizens, they have accomplished wonders. To the materially minded the hospitals which they have built (and administered so well) stand as monuments to their good work much as St. Paul's Cathedral rises over Sir Christopher Wren. To those interested in statistics the constantly falling mortality rates from tuberculosis in these Southern states attest the success of their efforts. To the humanitarian the thousands of recovered lives of patients treated and the millions of healthy, tuberculosis-free citizens, both children and adults, are their living monument.

In summary, the incidence of tuberculosis has been modified in the Southern states by a number of factors, including climate, biracial population, and economic conditions. Of these, the last has been most important, both in causing the high death rates from tuberculosis in the past and, more recently, in leading to the improvement in health which is now taking place. Of equal importance with these epidemiologic factors are the efforts of the men, so well represented by the late Dr. Paul P. McCain of North Carolina, who have tirelessly applied our knowledge of the causes of tuberculosis to the control of this disease in the South.

6. Chaille, S. E.: The Climatotherapy of the American Mountain Sanitarium for Consumption, New Orleans M. & S. J. 3:791-806, 1876.

When a physician encounters an infant or child with a positive tuberculin test, he has six clear-cut responsibilities: he must classify or describe the lesion, judge activity, determine communicability, seek the source of infection, make recommendations for therapy based on specific objective data and, last, follow each patient carefully at frequent intervals at least until all evidences of activity have subsided or until resolution of the initial lesion is complete. —R. V. Platou, Am. Rev. of Tbc., April, 1947.

RECENT ADVANCES IN THE CHEMOTHERAPY OF TUBERCULOSIS

H. McLeod Riggins, M.D.*

New York

Despite the remarkable achievements attained during recent years in the chemotherapy of the infectious diseases, many questions remain unanswered and many problems unsolved. One of the most important of these problems is the chemotherapy of tuberculosis. Although the mortality rate from tuberculosis has steadily declined during the past half-century, it remains the first cause of death during the most productive years of life, and is still responsible for approximately fifty thousand deaths annually in the United States. The need for more effective preventive and therapeutic measures for the treatment and control of tuberculosis is obvious.

Historical Background

For centuries, chemotherapy has been sporadically and often empirically applied in the treatment of tuberculosis. Numerous drugs and chemical compounds have been tested in the experimental laboratory and clinically. Many agents have been shown to have varying degrees of bacteriostatic or bactericidal effect on Mycobacterium tuberculosis *in vitro*, but until recently all have proved ineffective against tuberculosis in experimental animals and human patients.

Unjustified claims have been made concerning the therapeutic value of a large number of chemical agents in tuberculosis, despite experimental and clinical evidence to the contrary. The prolonged and sporadic use of gold salts, despite their severe toxic effects, is an illustration in point.

The fundamental nature of tuberculosis, the characteristics of the tubercle bacillus, and the innumerable variables in the parasite-host relationship have contrived to encourage, disillusion, and foil chemotherapists in this field, despite persistent efforts.

The accumulation of fundamental knowledge in the basic sciences, especially during the latter part of the nineteenth century and thereafter, made possible the first great chemotherapeutic achievement against the infectious diseases—the demonstration by Ehrlich and Hata in 1910 that salvarsan is effective in the treatment of syphilis. This achievement rekindled expectation that chemotherapeutic agents might be discovered which would successfully combat the infectious diseases, including tuberculosis. Following Ehrlich's discovery, however, further progress in chemotherapy of the infectious diseases was slow and disappointing.

Among those disappointed was Robert Koch[1], who turned his attention from chemotherapy to tuberculin therapy. Koch and many others held great hope for tuberculin therapy, and for some time experimental pathologists, immunologists, and clinical investigators were to explore and emphasize the potentialities of the immunobiologic approach to the therapy of the infectious diseases.

Precise knowledge of tuberculosis has accumulated largely during the past half-century. Because of the early lack of such knowledge, treatment of this ancient malady was constantly changing, and until comparatively recent times was of limited success.

Numerous drugs[2] and chemical compounds have been tested in the treatment of experimental and human tuberculosis. Arsenical preparations have been used since the eleventh century; gold and mercury since the sixteenth century; and cod liver oil and creosote since about the seventeenth century.

Throughout the years the effectiveness of these and other chemotherapeutic agents for the treatment of tuberculosis has remained highly controversial, and their mode of action conjectural. Claims concerning their therapeutic effect were usually based on clinical impressions, fortified somewhat in more recent years by the knowledge that certain chemical compounds inhibit the growth of tubercle bacilli *in vitro*. Koch and others, however, repeatedly emphasized that the bacteriostatic or bactericidal action of a chemical substance *in vitro* does not imply that the drug will exert a similar effect on the tubercle bacillus *in vivo*. Koch[1] also emphasized that "the success of an animal experiment gives no certain indication of

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1. Koch, Robert: The Cure of Consumption. Further communications on a remedy for tuberculosis (Trans. from orginal paper published in Deutsche med. Wchnschr., Leipzig), London, W. Heinemann, 1890.
2. Hart, P. D.: Chemotherapy of Tuberculosis; Research during the Past 100 Years, Brit. M. J. 2:805 (Nov. 30); 849 (Dec. 7) 1946.

the result of the same experiment upon human beings." Had this basic principle been given due consideration through the years, much of the sporadic over-enthusiasm on the part of some clinicians regarding the value of certain chemotherapeutic agents in the treatment of tuberculosis might have been avoided.

It is essential that this fundamental principle be applied in the present evaluation of the therapeutic effect of such antibacterial agents as the sulfones and streptomycin in the treatment of tuberculosis. It has been demonstrated that the antituberculosis action of the sulfones[3] is much greater in experimental animals than in human patients. It should also be emphasized that the toxic effect of antibacterial agents used in the treatment of tuberculosis may be significantly different in experimental animals and in man. Streptomycin causes vestibular dysfunction frequently in man, but rarely in experimental animals.

Various gold salts, one of the most recent being sanocrysin[4], have been used sporadically in the treatment of tuberculosis for centuries. Following the demonstration by Koch that gold salts inhibit the growth of tubercle bacilli *in vitro*, their use again became popular, particularly in Europe, despite the fact that Koch emphasized that they did not favorably influence the course of experimental tuberculosis in animals. Sanocrysin was used widely between 1924 and 1936; its application has declined again during the past few years, however, after further demonstration that it does not significantly alter the course of tuberculosis in animals or man, but that it produces severe toxic reactions in man[5].

3. (a) Feldman, W. H., Hinshaw, H. C. and Moses, H. E.: Effect of Promin on Experimental Tuberculosis; Preliminary Report. Proc. Staff Meet., Mayo Clinic. 12:695-699 (Oct. 30) 1940; (b) Medlar, E. M. and Sasano, K. T.: Promin in Experimental Tuberculosis in Guinea Pig. Am. Rev. Tuberc. 47:618-624 (June) 1943; (c) Steenken, W. Jr., Heise, F. H. and Wolinsky, E.: Treatment of Experimental Tuberculosis in Vaccinated and Nonvaccinated Guinea Pig with Promin, Am. Rev. Tuberc. 48:453-460 (Dec.) 1943; (d) Feldman, W. H., Hinshaw, H. C. and Moses, H. E.: Promin in Experimental Tuberculosis. Am. Rev. Tuberc. 45:303-333 (March) 1942; (e) Feldman, W. H., Mann, F. C. and Hinshaw, H. C.: Promin in Experimental Tuberculosis, Am. Rev. Tuberc. 46:187-195 (Aug.) 1942; (f) Feldman, W. H., and Hinshaw, H. C.: Promin in Experimental Tuberculosis, Am. Rev. Tuberc. 48:256-260 (Oct.) 1943.

4. Mollgaard, H.: Chemotherapy of Tuberculosis, Copenhagen, Busch, 1924.

5. Amberson, J. B., Jr., McMahon, B. T., and Pinner, M.: Clinical Trial of Sanocrysin in Pulmonary Tuberculosis, Am. Rev. Tuberc. 24:401-435 (Oct.) 1931.

Early observations on bacterial antagonisms

The significant observations by Tyndall[6] in 1876, and by Pasteur and Joubert[7] in 1877 that certain microorganisms are antagonistic to other bacteria did not go unheeded. Further developments in this field were destined to pave the way for later extensive investigation in the field of microbiology, and the eventual perfection of effective antibiotic therapy for many of the infectious diseases.

Almost three quarters of a century ago, Pasteur and Joubert[7] prophesied that this antibiosis or antibiotic action of certain bacteria might have therapeutic potentialities. Despite their prediction, very little progress was made in this direction for another thirty-five years, or until the early part of the twentieth century.

In 1912 and 1913, Rappin[8] announced that the filtrate of broth cultures of Bacillus subtilis, Bacillus mesentericus and Bacillus megatherium strongly inhibited the growth of the tubercle bacillus *in vitro*. He also claimed that injections of filtered cultures of B. mesentericus significantly altered the course of experimental tuberculosis in animals.

At about the same time, Vaudremer[9] announced that Aspergillus fumigatus "digested" the tubercle bacillus *in vitro*. Between 1910 and 1913 he treated some 200 tuberculous patients with a filtrate of A. fumigatus, and reported varying degrees of improvement in some and none among others.*

Although these encouraging results of antibiotic therapy for experimental and clinical tuberculosis were not widely accepted, they undoubtedly increased interest and investigation concerning the possibilities of antibiotics in the treatment of the infectious diseases.

6. Tyndall, J.: The Optical Deportment of the Atmosphere in Relation to the Phenomenon of Putrefaction and Infection. Phil. Tr. Roy. Soc. London, 166-27, 1876.

7. Pasteur, L. and Joubert, J.: Chimie Physiolosique-Charbon et Septicemie, Compt. rend. Acad. d. Sc., Paris, 85:101, 1877.

8. Rappin, G.: (a) Immunisation antituberculeuse. Prov. medicale. Paris, 23:469-473, 1912; (b) Action excercee par les Diastases de quelques especes des Saprophytes sur la Tuberculose experimentale du Cobaye. Prov. medicale, Paris, 24:45, 1913.

9. Vaudremer, A.: (a) Action de l'extrait d'Aspergillus fumigatus sur la tuberculine, Compt. rend. Soc. de biol., Paris, 73:501-503, 1912; (b) Action de l'extrait filtre d'A. fumigatus sur les bacilles tuberculeux. Ibid. 74:278-280; 752-754, 1913.

* In recent years two antibiotics of A. fumigatus —fumigacin and fumigatin—have been isolated. Both inhibit the growth of tubercle bacilli **in vitro.**

Recent Advances in Chemotherapy

Further real progress in chemotherapy of the infectious diseases was to await the demonstration that sulfanilamide and its derivatives were effective in the treatment of pyogenic infections in experimental animals and in human patients. Sulfanilamide and its derivatives, however, were found ineffective in the treatment of experimental and human tuberculosis.

A few years later the sulfone compounds, promin, promizole and diazone—synthetic preparations related to the sulfonamide drugs—were found to alter significantly the course of experimental tuberculosis. The sulfones proved far less effective in human beings, however, than in experimental animals.

There is some evidence to suggest that the combined use of promizole and streptomycin is more effective in the treatment of certain forms of tuberculosis than is either drug used alone. The usefulness of the sulfone compounds in combination with streptomycin is still under investigation.

Streptomycin

Streptomycin, an antibiotic substance, was first obtained from the fungus Actinomyces (Streptomyces) griseus by Schatz, Bugie and Waksman[10] in 1944. It exerts a decided bacteriostatic effect on the tubercle bacillus *in vitro* and a suppressive action against experimental and clinical tuberculosis.

Mechanism of action

The mechanism of the antibacterial action of streptomycin and other antibiotics is not definitely known, but at least three theories have been propounded: (a) bacteriostatic, (b) bactericidal and (c) bacteriolytic[11]. Although several antibiotics have been demonstrated to inhibit the growth of tubercle bacilli *in vitro*, streptomycin is the only one that has been shown to have a beneficial effect on both experimental and clinical tuberculosis without prohibitive toxic effects.

Uses

Feldman and Hinshaw[12] have shown that streptomycin has a strikingly beneficial effect on experimental tuberculosis in animals. During the past four years Hinshaw and his associates[13] have continuously and extensively investigated the indications, usefulness, and limitations of streptomycin in the treatment of pulmonary and extrapulmonary tuberculosis in man. They have found that streptomycin has a significantly suppressive effect on the course of certain types of pulmonary tuberculosis, more especially on recent disease in which extensive caseation has not developed. Streptomycin has also been found beneficial in the treatment of extrapulmonary tuberculous infections, especially tuberculous fistulas leading to subcutaneous or deep-seated foci.

Baggenstoss and his coworkers[14] have studied the effects of streptomycin on miliary tuberculosis. They have found that not infrequently partial or complete remission of this usually fatal form of the disease may follow streptomycin therapy.

Bunn[15] has recently reported that of 71 patients with tuberculous meningitis treated with streptomycin in the Veterans Hospitals, one third died within six weeks after therapy was begun. Fifteen, or approximately 21 per cent of these patients, however, are now clinically well after completion of treatment. The spinal fluid is negative for tubercle bacilli on culture, but still shows a high protein content and pleocytosis in 13 patients. Two of the 15 patients became deaf, apparently as a result of streptomycin therapy. The remarkable results obtained by Bunn and his colleagues at the Veterans Hospitals in this usually fatal type of tuberculosis would suggest that it may be possible to salvage approximately 20 per cent of patients with tuberculous meningitis if the condition is treated early and adequately.

The drug has been found to have a remarkably rapid and beneficial effect on tuberculosis of the larynx, trachea, and bronchi. It appears to be more effective against acute and ulcerative lesions than against the chronic fibrostenotic types.

10. Schatz, A., Bugie, E. and Waksman, S. A.: Streptomycin, a Substance Exhibiting Antibiotic Activity against Gram-Positive and Gram-Negative Bacteria, Proc. Soc. Exper. Biol. & Med. 55:66-69 (Jan.) 1944.
11. Schatz, A. and Waksman, S. A.: Effect of Streptomycin and Other Antibiotic Substances upon Mycobacterium Tuberculosis and Related Organisms, Proc. Soc. Exper. Biol. & Med. 57:244-248 (Nov.) 1944.
12. (a) Feldman, W. H. and Hinshaw, H. C.: Effects of Streptomycin on Experimental Tuberculosis in Guinea Pigs; Preliminary Report, Proc. Staff Meet., Mayo Clin. 19: 593-599 (Dec. 27) 1944; (b) Hinshaw, H. C. and Feldman, W. H.: Streptomycin; A Summary of Clinical and Experimental Observations, J. Pediat. 28:269-274 (March) 1946.
13. Hinshaw, H. C., Feldman, W. H. and Pfuetze, K. H.: (a) Streptomycin in the Treatment of Clinical Tuberculosis, Am. Rev. Tuberc. 54:191-203 (Sept.) 1946; (b) Treatment of Tuberculosis with Streptomycin, J.A.M.A. 132:778-782 (Nov. 30) 1946.
14. Baggenstoss, A. H., Feldman, W. H. and Hinshaw, H. C.: Streptomycin in Miliary Tuberculosis, Am. Rev. Tuberc. 55:54-76 (Jan.) 1947.
15. Bunn, P. A.: Personal communication.

Riggins and Hinshaw[16] have recently pointed out that streptomycin should be regarded as an adjunct to the conventional and effective methods of tuberculosis therapy now widely used, and not as a substitute for any of these.

The proper timing of streptomycin therapy for pulmonary tuberculosis with such procedures as pneumothorax, thoracoplasty and resection surgery should prove of distinct value. Thus used, streptomycin should significantly enhance the results obtained by different therapeutic procedures.

Disadvantages

Although streptomycin is rapidly excreted by patients with normal renal function, it may produce certain toxic effects, some of which are serious. Such effects are especially apt to occur if large daily doses of the drug are administered parenterally and intrathecally. It is believed that 1 Gm. given intramuscularly may prove to be the optimum daily dose for certain types of pulmonary tuberculosis. This dosage is decidedly less toxic than 2.0 to 3.0 Gm. daily. Toxicity does not appear to be as significantly related to *duration of treatment* as it is to *total daily dosage* and to improper excretion of the drug by patients with impaired renal function.

Another important disadvantage of streptomycin therapy is the development of streptomycin-resistant tubercle bacilli[17] *in vitro*, and presumably *in vivo*, among a significant percentage of patients treated over a considerable period of time. It appears that the development of this phenomenon during therapy will probably limit seriously the effectiveness of the drug in the treatment of tuberculosis.

Despite the demonstrated value of streptomycin in the treatment of certain types of tuberculosis, early diagnosis and good sanatorium and hospital care or its equivalent, combined with modern application of pneumothorax, the timely use of thoracic surgery, and adequate rehabilitation with competent medical guidance and supervision, are likely to remain the fundamental basis of the management and treatment of tuberculosis for some time to come.

The Task of the Future

Although one can readily agree with Hart that a substantial part of the bacterial front has been broken as a result of the recent remarkable achievements in chemotherapy of the infectious diseases, nothing resembling a decisive victory of man over micro-organisms can be claimed until world control of tuberculosis is attained.

Summary and Conclusions

1. For centuries numerous drugs and chemical compounds have been used in the treatment of tuberculosis. Until recently none has proved of value.

2. The sulfones and streptomycin have been found to exert a significantly beneficial effect on the course of tuberculosis in experimental animals.

3. Streptomycin has also been shown to exert a remarkable therapeutic effect on tuberculous meningitis and on miliary tuberculosis. Its use for these usually fatal forms of tuberculosis is regarded by many as mandatory. It may also be of significant benefit in certain types of pulmonary and extrapulmonary tuberculosis in man, especially those lesions which have not progressed to extensive caseation and necrosis.

4. Streptomycin has certain toxic potentialities, particularly when used in large doses. Most of its toxic effects are transitory, but some may be permanent and serious. Toxic manifestations may be greatly minimized if the daily dose does not exceed 1 Gm. This dosage appears to influence favorably the course of certain types of pulmonary and extrapulmonary tuberculosis. The toxic effects of the drug must be weighed against the immediate or remote threat of the disease.

5. After an indefinite period of exposure to streptomycin, tubercle bacilli usually become resistant to the antibiotic *in vitro* and presumably *in vivo*. When this phenomenon occurs, the drug appears to lose much if not all of its therapeutic value.

6. Streptomycin should never be used as a substitute for proved methods of treating tuberculosis, but only as an ancillary agent and in conjunction with other basic therapeutic procedures.

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TREATMENT OF TUBERCULOSIS WITH STREPTOMYCIN

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A few months before his death Dr. P. P. McCain applied to the United States Public Health Service for a grant to support a study on the use of streptomycin in tuberculosis. The story of this drug and of its use to date in the treatment of this disease appears to be a suitable topic for a contribution to this memorial issue of the JOURNAL.

It was a modest statement which Schatz, Bugie and Waksman[1] made three and a half years ago when they announced the discovery of "a new antibacterial substance, designated as streptomycin" which they had isolated from Actinomyces griseus. A second statement[2] a few months later indicated that this antibacterial substance inhibited the growth of Mycobacterium tuberculosis in the culture tube. Within a year after the original announcement, Hinshaw and Feldman[3] had applied the drug to tuberculous guinea pigs and human patients with favorable results.

Since that initial venture, a remarkably significant record has been written in the life history of a remarkably resistant disease. For the first time, a drug is available which exerts a distinctly favorable effect upon a good many types of tuberculosis. Its use in miliary tuberculosis, tuberculous meningitis, and several of the extrapulmonary forms of the disease has achieved far better results than those obtained by any other method of treatment.

The drug has been scarce. It has been available in limited amounts to a few independent investigators, to the Veterans Administration and the Army and Navy, to the American Trudeau Society, and to the United States Public Health Service. These groups together have been responsible for the completed treatment of about 1500 cases to date; in addition, approximately 1000 patients are now receiving this therapy or are about to be started on an outlined therapeutic scheme. The Veterans Administration, the Army and the Navy began their work in June or July, 1946. Almost a year ago the Committee on Streptomycin of the American Trudeau Society obtained a generous donation of 54 Kg. of the drug from the manufacturers for study, and to this amount another 27 Kg. has recently been added. The material has been distributed to eight investigators, who have worked in singularly good cooperation. This work, under the direction of this voluntary agency, has tied in closely with the efforts of several independent investigators, as well as with those of the other agencies mentioned. In general the work has been divided into the following categories:

1. Experiments in the laboratory.
2. Clinical administration and appraisal.
3. Collection and analysis of data.

Experiments in the Laboratory

Very early in the work it became evident that the tubercle bacillus rather regularly develops resistance to streptomycin, and that it is useless to administer the drug longer than three months if the dose has been very large[4]. The nature of this resistance is under study. Whether it represents biologic adjustment to a new environment, or the survival and increasing preponderance of natively resistant bacilli which were previously in the body in small numbers is not known.

Many people interested in this question are speculating upon the potentials in the development of resistance to streptomycin. This possibility is still in the speculative state, because insufficient time has passed to allow final evaluation. It is a fact, however, that resistance, once acquired, tends to become attached to the strain as a characteristic. Some strains examined eight and ten months after the development of resistance have been found to have retained this trait. This represents the longest period of observation to date.

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2. Schatz, A. and Waksman, S. A.: Effect of Streptomycin and Other Antibiotic Substances Upon Mycobacterium Tuberculosis and Related Organisms, Proc. Soc. Exper. Biol. & Med. 57:244-248 (Nov.) 1944.
3. (a) Feldman, W. H. and Hinshaw, H. C.: Effects of Streptomycin in Experimental Tuberculosis in Guinea Pigs, Proc. Staff Meet., Mayo Clinic, 19:593-599 (Dec. 27) 1944; (b) Hinshaw, H. C. and Feldman, W. H.: Streptomycin in the Treatment of Clinical Tuberculosis: Preliminary Report, Ibid, 20:313-318 (Sept.5) 1945.
4. (a) Youmans, G. P., Williston, E. H., Feldman, W. H. and Hinshaw, H. C.: Increase in Resistance of Tubercle Bacilli to Streptomycin; Preliminary Report, Proc. Staff Meet., Mayo Clinic 21:126-127 (March 20) 1946; (b) McDermott, W.: Toxicity of Streptomycin, Am. J. Med. 2: 491-500 (May) 1947; (c) Farrington, R. F., Hull-Smith, H., Bunn, P. A. and McDermott, W.: Streptomycin Toxicity; Reactions to Highly Purified Drug on Long-Continued Administration to Human Subjects, J.A.M.A. 134:679-688 (June 21) 1947.

What are the implications of this observation? If the resistant strain is passed on to a previously uninfected person, it will continue to be resistant to the drug. Even if it produces in that person a type of tuberculosis that is ordinarily susceptible to streptomycin, the drug will have no effect upon his disease. It is conceivable that resistant strains may be passed on in this manner, and that an increasing number of people may contract tuberculosis which is not amenable to the drug. Such a development would eventually destroy the usefulness of streptomycin in tuberculosis.

It seems important, therefore, in the administration of this drug (1) to anticipate the development of resistance and (2) to refuse to use the drug for types of tuberculosis in which it has not been shown to be helpful. In order to anticipate the development of resistance, one should make frequent *in vitro* examinations of the strain after the first six or eight weeks of treatment, and discontinue the therapy at once as soon as it begins to show resistance. One should also refuse to continue the administration of the drug for more than three months if the dose has been as great as 1 Gm. per day. The drug should be withheld in the large number of chronic, fibrous, cavitary cases that represent the "average" case of tuberculosis, because these do not respond.

Other laboratory studies under way are concerned with the toxic manifestations and limitations of dose, and with the excretion of the drug, especially by people with renal impairment. A large proportion of people with damaged kidneys develop toxic symptoms when they are given this drug. Other work is in progress which supplements clinical studies and seeks to explain some of the clinical results; some of it represents treatment of experimental tuberculosis with streptomycin, and some is study upon autopsy material from the bodies of people who have died from tuberculosis while being treated with the drug. Some of it is chemical in nature and seeks further purification of streptomycin, and some of it extends to a study of other antibiotics.

Clinical Administration and Appraisal

A great deal has been accomplished to date in the clinical application of streptomycin, but little actually is known about it. Although many cases have been studied, much remains to be done. But this much can be said: that in certain types of tuberculosis streptomycin works well—far better than any other drug ever brought forward. It is by far the best therapy that has yet been used for miliary tuberculosis. A considerable number of patients with this disease have experienced great benefit from streptomycin therapy. Most of them have lost their symptoms; the x-ray improvement has been remarkable; the sputum has become negative; and about 50 per cent of them appear to be well four to twelve months after treatment. Obviously one cannot use the word "well" in connection with tuberculosis, but the patients are without clinical symptoms of illness. In tuberculous meningitis the results are much the same; at three to six months after cessation of treatment about half of the patients are living, but at eight to twelve months after discontinuation, only about 25 per cent are still alive. Quite a number of these, however, are without symptoms, and a few yield spinal fluid that is quite normal. In tuberculosis of the mucous membranes—particularly of the larynx, trachea and bronchi—the drug exerts a very favorable and rapid influence.

In these three types of tuberculosis the results have been so striking that it is incumbent upon the physician to use streptomycin when he encounters such cases. The drug has also led to marked improvement in patients with draining sinuses from lymph nodes and, at times, from tuberculous lesions of the bone. Tuberculosis of the skin does well under streptomycin. In a large majority of patients with the types of tuberculosis which have been mentioned, remission follows the use of the drug, and in a considerable number it appears that such remission may be reckoned as permanent.

The sobering thought, however, is that in 70 or 80 per cent of all cases of pulmonary tuberculosis the drug as yet has been found of very little benefit. The average case of chronic, ulcerative, cavitary, fibrous tuberculosis yields very little, if any, to it. In almost all cases of pulmonary tuberculosis streptomycin is followed within a few days by loss of fever, diminution in cough, lessening of the amount of sputum, and a definite change in the character of the sputum from thick, purulent or mucopurulent to mucoid. These

objective signs are accompanied by a feeling of well-being and often by an increase in appetite, although occasionally the patient finds that the drug abolishes his appetite almost entirely. As a rule, however, this improvement does not last, and in the end the chronic case of consumption progresses about as though the drug had not been used.

Further clinical use of streptomycin has offered certain additional therapeutic suggestions. For instance, good results follow its use in very early (not minimal) tuberculosis. In tuberculous pneumonia, particularly if it is caught in the early days of its inception, the response is frequently remarkable. The use of the drug in tuberculous enteritis has apparently given good results. Quite often the patients with this complication will experience defervescence within three or four days after the beginning of treatment. This is followed by loss of abdominal pain and discomfort, and a day or so later by a change in the character of the stool. The foul odor disappears, and in ten days or two weeks the stool is formed. Experience with the use of the drug in this disease has been limited, however, and the whole subject of tuberculous enteritis is now under more careful study. The same is true for tuberculosis of the bones and joints.

The prophylactic use of streptomycin has also come in for study and for practical application. In cases requiring thoracic surgery it has become almost standard procedure to administer the drug prophylactically. This practice seems to be unnecessary in the performance of thoracoplasty, because spread occurs only very seldom after this operation; in resection, however—where it is necessary for the surgeon to cut through tissues that harbor living tubercle bacilli—it is highly important to use streptomycin. The drug is being used regularly in such cases as a study project by the Veterans Administration.

As studies have gone further, many questions have been raised and many problems have presented themselves. In spite of the fact that 1500 cases have been studied to date, no one yet knows what the drug really does in tuberculosis of many parts of the body—particularly the lymphatic system, the bone, the eye, the genito-urinary tract, the skin, and many types of pulmonary tuberculosis. It is worth mentioning again, however, that the ordinary pulmonary tuberculosis most frequently encountered is but slightly affected by the drug.

In view of the widespread use which streptomycin is now beginning to receive, a word about the toxicity of the drug is in order; for it cannot be given without certain risks. It may cause cutaneous rash, and occasionally exfoliative dermatitis. Dizziness and vertigo are common, and impairment of hearing occurs rarely. Toxic symptoms are very likely to develop when the drug is given to people with renal impairment, as has already been noted; apparently the damaged kidney excretes streptomycin more slowly than the normal one, so that the drug is retained in the blood.

Note on one clinical study[5]

One series of observations may be mentioned briefly. This study involved 45 patients with early tuberculosis of the lung. For the most part they came from a large group of contacts that had been under observation by the health department of a large city, and the onset of the disease in most of them could be rather accurately dated. Of the 45 patients, 23 were given streptomycin and the remaining 22 had none of the drug. All patients were selected by the same set of criteria, and alternate cases (or nearly so) fell into the respective groups. In all cases the sputum yielded tubercle bacilli by one method or another. All patients received the same strict bed-rest regimen. Among the 23 patients who received streptomycin, "concentrate" study of sputum at the beginning of treatment was positive in 18; in only 1 did it remain so three to six months after treatment was discontinued. In the others the sputum became negative rather promptly and remained so. This test was positive at the beginning of the period of observation in 16 patients of the other group (the remaining 6 cases were positive upon culture); in only 9 did it become negative during the period of study.

Clearing of the x-ray shadow began by the twenty-second day (average) in the group treated with streptomycin, and by the forty-fourth day (average) in the series which received similar bed rest but no chemotherapy. Spread occurred in 3 cases of the

5. From a series of observations made at the Mayburv Sanatorium, Northville, Michigan, and the University of Michigan, Ann Arbor, by Jenkins, Peck, Reid and Willis; the report on this study is now in press.

latter group, but in none of the former. The degree of x-ray regression during the six-month period averaged 90 per cent in the streptomycin group, 48 to 50 per cent in the control group.

It should be emphasized, however, that although this type of *early* tuberculosis responds well, the average "garden" variety does not.

Clinical deductions

The kaleidoscopic nature of tuberculosis, the sometimes bizarre effect of the drug upon it, and the fact that streptomycin at best merely supplements and does not replace accepted methods of treatment require that its use be confined to institutions for the treatment of the disease. The patient must have sanatorium care and all of the supportive treatment that tuberculosis has always required, along with collapse procedures and other necessary surgical methods. *The drug merely supplements and does not replace accepted therapy.*

Collection and Analysis of Data

It has just been stated that about 1500 cases have been studied to date. These have come mostly from the Veterans Administration and the other services, from the group treated by the American Trudeau Society through a donation from the manufacturers, and from a few independent workers. Studies are under way, particularly by the Tuberculosis Study Section of the United States Public Health Service, to seek further answers as soon as possible.

The plan is to get together chemist, bacteriologist, pathologist, and clinician to talk over the many problems and their interrelations, and to have all of them work concurrently on component parts of the larger problem. This plan is now being carried out in certain forms of pulmonary tuberculosis, in the hope that prompt and decisive answers concerning their response to streptomycin may be obtained. It is hoped that in a comparatively short time specific information may be obtained on the nature of action of the drug, on the types and the degree of tuberculosis that may safely and properly be treated with the drug, and also—just as important—on the clinical limitations of the drug.

At present the drug is being tried in several types of somewhat more chronic pulmonary tuberculosis than has heretofore shown signs of yielding to the drug. Studies are in progress on variations in dose, both as to size and as to interval. Studies are being carried forward in adults and children, and in white people and Negroes. More definite information is being sought on the use of streptomycin in tuberculosis of the bone and joint in children and adults, in various types of tuberculosis of the genito-urinary system, and in enteritis. Studies likewise are going forward as to the cause of vertigo, deafness and related symptoms, and other evidences of toxicity. Efforts are being made also to study the effect of streptomycin used in combination with other drugs, notably the sulfones.

All in all, a considerable body of work is now in progress on this subject. In the work an effort is being made to apply certain controls to clinical studies by the method of having parallel cases for observation.

The Tuberculosis Study Section of the Public Health Service, composed of tuberculosis specialists throughout the country who do not hold government jobs, hopes to provide several answers to some of these important questions. This Study Section is working in close coordination with the Veterans Administration, and the results of their combined efforts will be forthcoming within the next several months.

Conclusions

1. Streptomycin should be used in miliary tuberculosis, tuberculous meningitis, tuberculous sinuses and fistulas, and certain cases of "early" tuberculosis known to have been present only a few days or weeks.

2. The drug should not be used in the average case of chronic fibrous or cavitary tuberculosis.

3. It should not be given to patients unless the functional capacity of the kidneys is known to be normal.

4. It should always be reckoned as an *adjunct* to the accepted measures of bed rest and collapse therapy, and *never as a substitute* for these.

5. Since it is given to patients with active disease, it is highly desirable that the patient be in a sanatorium during treatment.

6. Extensive clinical and laboratory study is in progress on this drug.

STREPTOMYCIN THERAPY IN TUBERCULOSIS OF THE TRACHEO-BRONCHIAL TREE

A Preliminary Report

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To date no large series of cases of tracheobronchial tuberculosis treated with streptomycin has appeared in the literature. Excellent results have been reported in two small series[1]. This preliminary report is made at this time so that it may be added to the accumulated experience.

The adverse effect which the presence of bronchial or tracheal tuberculosis, or both, has upon the treatment and the course of pulmonary tuberculosis is well known. Elimination or improvement of the bronchial condition for even a short period of time should favorably influence the healing process of the pulmonary lesion. The use of streptomycin in patients with pulmonary tuberculosis who were coincidentally under treatment for endobronchial tuberculosis, and in some who received streptomycin specifically for endobronchial disease, forms the basis for this report. The diagnosis and complications of endobronchial tuberculosis are outside the scope of this paper.

Classification of Cases

The total number of patients observed[2] was 18—5 male and 13 female. The average age of the patients was 33. Many of the cases were under observation for a considerable period of time before streptomycin became available. The location and extent of the lesions in these patients are described in the abstracted case histories given below. The endobronchial lesions are classified as follows: redness or inflammation, ulceration, granulation, swelling, scarring and stenosis. A patient may have more than one of these types of lesions in any combination.

The patients observed in this study represent all phases of endobronchial disease, from acute, fulminating, ulcerative lesions to healed, stenotic lesions. There was one case of stenosis with no active mucosal lesion. The remaining patients showed one or more of the following evidences of active disease: erythema, edema, ulceration, and granulation, with or without narrowing of the bronchial lumen.

The duration of the disease ranged from three weeks to four and a half years, the average being 11 months. This is only an approximate figure, because many inaccuracies were encountered as to the date of onset of symptoms of endobronchial disease. Several patients presented signs and symptoms of endobronchial disease many months before the lesion was diagnosed bronchoscopically, and in some instances routine bronchoscopy has revealed the presence of endobronchial disease when it was not suspected clinically.

Dosage of Streptomycin

The exact therapeutic dosage of streptomycin in endobronchial disease is not well established. The relative merits of aerosol streptomycin are open to some question. None of the patients in this series received aerosol streptomycin alone. In 2 of the patients who received intramuscular streptomycin alone the response was very dramatic. The drug was given at the rate of approximately 1 Gm. a day. The dosage was usually doubled for the first week, and toward the end of treatment was reduced to 0.5 Gm. a day. In some instances the daily dose was divided into as many as five injections of 0.2 Gm. per day. Two patients received 2 Gm. a day for thirty and thirty-eight days respectively; no special benefit could be observed to result from this prolonged increase in dosage. The largest total amount of streptomycin given was 190.5 Gm. over a period of one hundred and thirty-five days; this long period of therapy did not seem to confer any definite benefit. The most dramatic

1. (a) Hinshaw, H., Feldman, W. H., and Pfuetze, K. H.: Streptomycin in Treatment of Clinical Tuberculosis, Am. Rev. Tuberc. 54:191-203 (Sept.) 1946; (b) Veterans Administration Technical Bulletin, TB 10-34, p. 6, August 5, 1947.
2. The patients observed were under the care of the following doctors and institutions in Saranac Lake and vicinity: Dr. E. N. Packard, Trudeau Sanatorium (7 cases), Dr. George Wilson and the Will Rogers Memorial Hospital (3 cases), Dr. J. Woods Price (2 cases), Dr. J. N. Hayes (2 cases), Dr. F. B. Trudeau (2 cases), Dr. Wayne Henning, Stony Wold Sanatorium (1 case), and the Veterans Administration Hospital at Sunmount, Dr. Henry Walters, Manager (1 case). The patients of Trudeau Sanatorium received their streptomycin through the American Trudeau Society grant.

effect was obtained in a patient whose lesion was discovered three weeks previous to therapy; the patient received 82 Gm. in eighty-two days, with almost complete disappearance of the endobronchial lesion two weeks after initiation of streptomycin therapy.

Results of Treatment

The results of the treatment are as follows: One patient (case 15), classified as slightly improved, was not satisfactory for study because she was sensitive to streptomycin and the drug had to be discontinued; desensitization was attempted without success. One patient (case 14), who had stenosis without active involvement, showed no change under streptomycin therapy. Two patients (cases 7 and 18) showed no change and were classified as unimproved. In 4 patients (cases 2, 9, 11, 13) there was improvement, with some residual swelling but no active ulceration or granulation. In 10 patients (cases 1, 3, 4, 5, 6, 8, 10, 12, 16, 17) the lesions healed, but left residual stenosis. Two of these 10 patients had a recurrence of the endobronchial disease, one month (case 6) and two months (case 4) later. In the remaining 8 cases the lesions have remained healed to date, and the patients are clinically improved.

Table 1 summarizes the essential data in this series of cases.

Report of Cases

Case 1

A woman, aged 33, with minimal pulmonary tuberculosis, was suspected of having bronchial disease in June, 1942. On September 3, 1946, bronchoscopy revealed granulation of the right middle lobe bronchus and bronchus intermedius. Streptomycin was started on January 17, 1947. She received 2 Gm. of streptomycin daily for thirty-eight days, 1 Gm. daily for twenty-two days, and 0.5 Gm. daily for thirty-two days—a total of 114 Gm. in ninety-two days. Bronchoscopy on March 4 showed the lesion to be improving. Bronchoscopy on April 22 showed no evidence of active disease, but narrowing of the right main bronchus as a result of scar tissue. The patient's sputum became negative. She has remained well and the bronchial lesion has healed, but there is moderate narrowing of the bronchus.

Case 2

A 44-year-old female with far-advanced pulmonary tuberculosis was suspected of having bronchial disease in October, 1946. Bronchoscopy done elsewhere showed involvement of the left main bronchus. Bronchoscopic examination on October 26, 1946, prior to streptomycin therapy, showed redness, ulceration, and granulation of the left main bronchus. Intramuscular streptomycin therapy was started on January 30, 1947. The patient received 2 Gm. a day for thirty days, 1 Gm. for thirty-one days and 0.5 Gm. for fifty-nine days. Aerosol streptomycin was started on March 11, 1947, 0.5 Gm. daily being given for thirty-six days. After a week's intermission aerosol streptomycin was started again and continued, in the same dosage, for seventy-five days.

Bronchoscopic examination on March 4 showed no improvement. On April 8 less granulation tissue was seen. On May 20 there was redness but no granulation or ulceration; some narrowing was noted, however. On June 24 bronchoscopy showed some redness and narrowing. Bronchoscopy on August 12 showed no change, although one observer

Table 1

Case	*Duration of Disease before Therapy (Months)*	*Total Dosage of Streptomycin (Grams)*	*Days of Treatment*	*Result*
1	48	114 i.m.	92	Healed
2	36	135 i.m.	135	Improved
		55.5 a	111	
3	14	77 i.m.	71	Healed
		19 a	38	
4	6	52.5 i.m.	88	Lesion healed, then recurred
5	4	30.5 i.m.	41	Healed
6	9	81 i.m.	86	Lesion healed, then recurred
		19.75 a	72	
7	30	45 i.m.	49	Unimproved
8	11	38.5 i.m.	43	Healed
		13 a	13	
9	1	29.5 i.m.	59	Improved
10	18	42 i.m.	42	Healed
11	5	90 i.m.	90	Improved
12	11	35 i.m.	35	Healed
13	12	70 i.m.	98	Improved
14	36	14 i.m.	14	No change
		27 a	27	
15	24	20 i.m.	19	? Improved
16	1	84 i.m.	84	Healed
17	36	42 i.m.	42	Healed
18	24	72 i.m.	90	Unimproved

i.m.=intramuscular
a=aerosol

felt that redness indicated that the lesion was somewhat worse. Streptomycin was started again on August 17 in a dose of 1 Gm. daily, and was continued for fifteen days. The patient's sputum has been negative since the forty-ninth day of treatment. She received 135.5 Gm. of streptomycin intramuscularly in one hundred and thirty-five days, and 55.5 Gm. by aerosol in one hundred and eleven days.

Case 3

A 36-year-old woman had minimal pulmonary tuberculosis. Bronchial disease was suspected in January, 1946. Bronchoscopy in Philadelphia on August 5, 1946, showed involvement of the right upper lobe bronchus and right main bronchus. The patient had three bronchoscopic examinations prior to streptomycin therapy; all showed granulation, ulceration, and narrowing of the right main bronchus. Intramuscular streptomycin was started on February 25, 1947. The patient received 2 Gm. daily for six days, then 1 Gm. daily for forty-two days. After a week's intermission the drug was resumed in a dose of 1 Gm. daily for twenty-three days, making a total of 77 Gm. in seventy-one days. Aerosol streptomycin was begun on March 4 in a dose of 0.5 Gm. a day for thirty-eight days—a total of 19 Gm. in thirty-eight days.

Bronchoscopy on April 11 showed marked improvement; the mucosa was relatively normal, but there was some stenosis. The patient showed marked clinical improvement, and the Gaffky count was reduced from vii to ii. Bronchoscopy on September 4 showed complete healing of the bronchial mucosa and less narrowing of the airways. The patient's sputum at this time was negative.

Case 4

A female patient, aged 36, with moderately advanced pulmonary tuberculosis, was suspected of having endobronchial disease in August, 1946. Bronchoscopy elsewhere revealed involvement of the trachea and left main bronchus. Two bronchoscopic examinations done prior to streptomycin therapy showed ulceration and granulation of the left main bronchus. At the second bronchoscopy the area was treated with silver nitrate solution (25 per cent). Streptomycin therapy was started on February 3, 1947, the patient receiving 2 Gm. a day for four days, 1 Gm. a day for five days, and 0.5 Gm. a day for seventy-nine days—a total of 52.5 Gm. in eighty-eight days. Bronchoscopy on March 25 showed healing of the active lesion, with some scarring and stenosis. Bronchoscopy on May 20 showed a recurrence of the ulceration and more stenosis. The sputum remained positive throughout. At the present time a thoracoplasty is being performed.

Case 5

A female patient, aged 33, had moderately advanced pulmonary tuberculosis. Endobronchial disease was suspected on September 5, 1944. Bronchoscopy on March 10, 1947, revealed ulceration and granulation in the left main bronchus, which was treated with silver nitrate. Bronchoscopic examinations on May 6 and on June 19 showed slight improvement in the active lesion, but some narrowing of the bronchus. Streptomycin was started on June 25. The patient received 1 Gm. a day for twenty days, then 0.5 Gm. a day for twenty-one days—a total of 30.5 Gm. in forty-one days. Bronchoscopy on September 4 showed that all the active lesions were entirely healed, but the narrowing remained. There was purulent secretion distal to the narrowing, presumably from the pulmonary lesion.

Case 6

A 36-year-old man with moderately advanced tuberculosis was suspected of having endobronchial disease in June, 1946. Bronchoscopy on February 4, 1947, revealed erythema and swelling of the left main bronchus with occlusion of the left upper lobe orifice. On fluoroscopy trapping of air in the left upper lobe was demonstrated. Streptomycin therapy was begun on February 11, both by aerosol and by intramuscular injection. He received intramuscularly 2 Gm. a day for two days, 1 Gm. a day for seventy days, and 0.5 Gm. a day for fourteen days. During the same period he received by aerosol 0.5 Gm. daily for seven days, 0.25 Gm. daily for sixty-five days. A total of 81 Gm. of streptomycin was given in eighty-six days by intramuscular injection, and 19.75 Gm. was given in seventy-two days by aerosol.

Bronchoscopy on July 23 showed no ulceration or granulation. There was, however, some narrowing of the left main bronchus. Fluoroscopy showed that there was no trapping of air in the left upper lobe. The patient remained clinically well for approximately one month, when there was a recurrence of symptoms. Bronchoscopy on September 19 showed a recurrence of ulceration, granulation, edema, and erythema in the left main bronchus.

Case 7

A woman, aged 40, had moderately advanced tuberculosis. Bronchial disease was suspected in September, 1944. Bronchoscopy on February 25, 1947, revealed narrowing of the right main bronchus, with active ulceration extending down into the bronchus intermedius. Streptomycin was started on March 24, the patient receiving 2 Gm. a day for four days, 1 Gm. a day for twenty-eight days, and 0.5 Gm. a day for seventeen days—a total of 44.5 Gm. in forty-nine days. Bronchoscopy on May 20 showed that the bronchus was narrowed to approximately 1 mm. in diameter, but that the mucosal lesion had improved. A culture of the sputum on June 25 was positive.

Case 8

A 27-year-old male patient with minimal tuberculosis was suspected to have endobronchial disease in March, 1946. Bronchoscopy in July, 1946, revealed ulceration, redness, and edema of the right upper lobe and right main bronchus. Bronchoscopy on March 4, 1947, revealed active disease in the right upper lobe bronchus. Streptomycin was started March 21, both by aerosol and by intramuscular injection. The intramuscular dose was 2 Gm. a day for four days, 1 Gm. a day for twenty-six days, and 0.5 Gm. a day for thirteen days—a total of 38.5 Gm. in forty-three days. Aerosol streptomycin was given in a daily dose of 1 Gm. for thirteen days. Bronchoscopy on May 13 revealed healing of the active disease, but some residual stenosis of the right upper lobe bronchus. The sputum was converted to negative.

Case 9

The patient was a woman, aged 38, with moderately advanced pulmonary tuberculosis. Bronchial disease was suspected in April, 1947. Bronchoscopy on April 15 revealed redness of the right upper lobe bronchus. Streptomycin was started on April 30, 1947, the patient receiving 0.5 Gm. daily for fifty-nine days, the total dose being 29.5 Gm. Bronchoscopy on June 10 showed improvement of the lesion in the right upper lobe bronchus; some swelling still persists, however.

Case 10

A 29-year-old woman with moderately advanced pulmonary tuberculosis began to have symptoms of endobronchial disease in November, 1945. Bronchoscopy on March 19, 1946, revealed swelling, redness, and ulceration of the left main bronchus; it was treated with 25 per cent silver nitrate at this examination. The patient subsequently had four bronchoscopies, the last one on April 15, 1947, showing no significant improvement. Streptomycin was started on May 2, the patient receiving 1 Gm. a day for forty-two days. Bronchoscopy on June 19 showed that the lesion was healed but that there was some stenosis in the left main bronchus. The patient's sputum culture remains positive, but the smear is negative.

Case 11

The patient was a male, aged 30, with far-advanced pulmonary tuberculosis. Endobronchial disease was first suspected in January, 1947. Bronchoscopy on June 3 showed edema, ulceration, and granulation of the right lower lobe in the region of the superior branch bronchus. Streptomycin, 1 Gm. a day, was started on June 2 and continued for ninety days. Bronchoscopy on August 19 showed improvement; there was no ulceration or granulation, but some redness and edema were still present. Because of the far-advanced parenchymal disease, functional studies were done. These showed that the right lung was performing very little of the total function, and pneumonectomy was performed on October 16.

Case 12

A 23-year-old woman with minimal pulmonary tuberculosis began to have symptoms of endobronchial disease in July, 1946. Bronchoscopy on June 10, 1947, showed narrowing and ulceration of the left upper lobe bronchus. Streptomycin was started in a dose of 1 Gm. daily on June 10, and was continued for five weeks. Bronchoscopy on August 12 showed no change in the lesion. On September 19 the lesion was found to be healed with stenosis.

Case 13

A male patient, aged 50, had far-advanced bilateral pulmonary tuberculosis. Endobronchial disease was first suspected in June, 1946, and was diagnosed on July 13, 1947. Bronchoscopic examination showed marked stenosis, scarring, and ulceration of the trachea and larynx. Streptomycin was started in April, 1947, in a dose of 0.5 Gm. a day for eight weeks. Because of the severe tracheal stenosis, it was necessary to do a tracheotomy on July 13. Streptomycin was again started on August 8, and continued for six weeks. Indirect examination of the trachea during this period showed clearing of the granulation and ulceration, but marked stenosis persisted. Streptomycin, in a dose of 1 Gm. a day, was again started on October 3. During the first two periods of streptomycin therapy he received 70 Gm. in ninety-eight days.

Case 14

The patient was a 32-year-old woman with minimal pulmonary tuberculosis, who was suspected of having endobronchial disease in April, 1944. Bronchoscopy done elsewhere on June 19, 1944, showed erythema of the left main bronchus. On July 22, 1947, bronchoscopic examination showed stenosis of the left main bronchus, but no ulceration or granulation. Streptomycin was given both by aerosol and intramuscularly. By intramuscular injection she received 1 Gm. daily, starting on July 24 and continuing through August 7—a total of 14 Gm. By aerosol she received one third of a gram three times a day, starting on July 24 and continuing through August 20—a total of 27 Gm. Bronchoscopy on August 26 showed no change in the stenosis.

Case 15

A female patient, aged 51, had far-advanced pulmonary tuberculosis. Endobronchial disease was first suspected in August, 1945, and was diagnosed on August 5, 1947, when bronchoscopy revealed redness and edema of the right upper lobe bronchus. This area was treated with 25 per cent silver nitrate at this time. Streptomycin was started on August 9. Two grams given daily for a period of one week produced a febrile reaction. She was successively tried on daily doses of 1 Gm., 0.5 Gm., and 0.25 Gm., but even these small doses produced reactions. She is now in the process of desensitization, after having received 20 Gm. in nineteen days. Bronchoscopy on October 7 showed slight improvement, but redness and edema are still present.

Case 16

The patient was a 23-year-old male with far-advanced pulmonary tuberculosis, whose endobronchial disease was first suspected on July 3, 1947. Bronchoscopic examination on July 9 showed disease of the right main, middle, and lower lobe bronchi, with extensive granulation, ulceration, and edema. Streptomycin, 1 Gm. daily, was started on July 23, 1947. He is still under streptomycin therapy. Bronchoscopic examination on August 6 showed the lesion to be healed except for one area, 1 mm. in diameter. Bronchoscopic examination on August 20 showed the lesion to be completely healed.

Case 17

A 43-year-old woman with minimal pulmonary tuberculosis was first suspected of having endobronchial disease in December, 1944. Bronchoscopy in December, 1944, showed stenosis, granulation, ulceration, and edema of the right main bronchus and the right upper lobe bronchus. Subsequent bronchoscopies on February 1, April 17, June 26, August 14, and October 16, 1945, showed no change. Silver nitrate (25 per cent) was applied to the lesions during the first five bronchoscopies with no marked benefit. Bronchoscopic examination on May 23, 1947, showed that the disease was still active and that stenosis had occurred. Streptomycin was started on August 9, and she was given 1 Gm. daily for forty-two days. Bronchoscopy on September 23 showed that all the inflammation had subsided and that the lesion was healed with stenosis.

Case 18

A 22-year-old female patient with far-advanced pulmonary tuberculosis was first suspected of having endobronchial disease in June, 1946. Bronchoscopy on June 25, 1946, showed marked stenosis of the lower portion of the trachea, with redness and edema. Streptomycin was started on April 12, 1947. She received 2 Gm. a day for four days, 1 Gm. a day for six weeks, and 0.5 Gm. a day for forty-four days—a total of 72 Gm. in ninety days. Bronchoscopy on July 8 showed no change in the bronchoscopic findings. The patient is now having a thoracoplasty.

Discussion

The observations on these patients have been made too recently to permit any conclusions as to how permanent the effect of streptomycin on endobronchial lesions will

be. That it does have a definite beneficial effect is substantiated by the above observations. Two patients, however, have had recurrences of endobronchial disease after complete healing with stenosis. The recurrence of endobronchial disease may be influenced by the extent of the parenchymal involvement and the development of resistance to streptomycin by the tubercle bacillus. The best effect is evidently obtained when streptomycin is used soon after the appearance of endobronchial disease, since those patients who showed a greater degree of stenosis and narrowing tended to show less response to the drug. The longer the endobronchial disease is present, the more likely it is to produce permanent damage and changes productive of narrowing.

The presence of endobronchial tuberculosis complicates the treatment of the pulmonary lesion. If the bronchial lesion can be rapidly improved, the contraindications to satisfactory therapy for the pulmonary lesion would be eliminated. The ideal end result is healing with a minimal amount of stenosis. It would seem that this could be effected if the lesions were diagnosed early and streptomycin therapy was instituted at an early date. Active disease seems to respond to streptomycin, but the stenotic lesions do not. If an active lesion can be healed at the earliest possible time, there should be little narrowing of the bronchial lumen.

Conclusions

1. Experience in 18 cases indicates that streptomycin therapy is of definite benefit in the management of endobronchial tuberculosis.

2. Early diagnosis of endobronchial lesions, with immediate institution of streptomycin therapy, tends to produce the most desirable result.

3. The long-range benefits of streptomycin therapy in endobronchial tuberculosis cannot be determined at the present time.

4. It must be borne in mind that the presence of extensive parenchymal disease would be favorable to the reactivation of endobronchial disease after streptomycin has effected healing.

The Greek death rate from tuberculosis is reported to be between 250 and 450 per hundred thousand of population as compared with 40 in the United States. —J.A.M.A., July 26, 1947.

ARTIFICIAL PNEUMOPERITONEUM IN NORTH CAROLINA

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During the past fifteen years the treatment of pulmonary tuberculosis with artificial pneumoperitoneum, with or without a phrenic nerve crush combined, has become increasingly popular. Recent reports[1], all emanating from Georgia and North Carolina, on the use of artificial pneumoperitoneum in nearly nineteen hundred white and colored patients provide ample evidence that this method of collapse therapy is sufficiently promising to warrant its inclusion, along with artificial pneumothorax and thoracoplasty, in the standard collapse procedures at present available to the physician. The history of artificial pneumoperitoneum, as well as its indications, advantages, complications, and physiology, has been discussed[1,2]. Exhaustive information regarding the entire subject is now available in the scholarly monograph of Banyai[3], who has courageously championed this method of collapse therapy in the United States.

The popularity of artificial pneumoperitoneum in North Carolina is attested by the frequency with which it is being used in the collapse therapy programs of the major sanatoria in this state. At the three state sanatoria situated at Sanatorium, Black Mountain, and Wilson, pneumoperitoneum is the method employed in about 50 per cent of all cases in which collapse therapy is used[4]. Other methods employed are artificial pneumothorax, separate phrenic nerve interruption, thoracoplasty, lucite plombage, and other surgical procedures. In the large Veterans Administration tuberculosis hospitals

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1. (a) Anderson, N. L. and Winn, W. D.: Pneumoperitoneum and Diaphragmatic Paralysis: Therapeutic Observations in 110 Negroes, Am. Rev. Tuberc. 52:380-391 (Nov.) 1945.
   (b) Crow, H. E., and Whelchel, F. C.: Diaphragmatic Paralysis and Pneumoperitoneum in 546 White Cases, Am. Rev. Tuberc. 52:367-379 (Nov.) 1945.
   (c) Mitchell, R. S., Hiatt, J. S., McCain, P. P., Easom, H. F., and Thomas, C. D.: Pneumoperitoneum in the Treatment of Pulmonary Tuberculosis: Results in 710 Cases from 1937 to 1946, Am. Rev. Tuberc. 55:306-331 (April) 1947.
   (d) Moyer, R. E.: Pneumoperitoneum and Phreniclasia in the Treatment of Pulmonary Tuberculosis: A Review of 500 Cases, Dis. of Chest, in press.
2. Anderson, N. L.: The Rationale of Therapeutic Pneumoperitoneum: Physiological and Mechanical Considerations, Dis. of Chest, in press.
3. Banyai, A. L.: Pneumoperitoneum Treatment, St. Louis, C. V. Mosby Co., 1946.
4. Statistics supplied through the courtesy of Drs. C. D. Thomas, H. F. Easom, and J. S. Hiatt.

at Oteen and Swannanoa, North Carolina, artificial pneumoperitoneum is used even more frequently, constituting approximately 60 per cent of their entire collapse therapy programs[5]. Although it is not intended to replace entirely such established methods of collapse therapy as selected artificial pneumothorax, there is good reason to believe that artificial pneumoperitoneum will increase still further in popularity. Since it is doubtful if any drug can fully replace the mechanical closure of many tuberculous cavities, it is quite probable that pneumoperitoneum will be utilized more frequently in the future in combination with the newer antibiotics such as streptomycin.

As more and more patients receiving artificial pneumoperitoneum are being discharged from these sanatoria and others, some difficulty is being encountered in finding local physicians who are familiar with the technique of administering artificial pneumoperitoneum refills. Thus it becomes incumbent on many general practitioners in the state to familiarize themselves with a simple office technique of administering artificial pneumoperitoneum refills to these discharged ambulant patients.

It is the purpose of this paper to familiarize the general practitioner with artificial pneumoperitoneum and to outline a simple and practical technique of administering refills in the office. Many chest physicians who are experienced in the use of both artificial pneumothorax and artificial pneumoperitoneum are inclined to believe that the latter is much easier to give. Actually, in the hands of relatively inexperienced physicians, artificial pneumoperitoneum refills are much safer than artificial pneumothorax refills.

Definition

What is artificial pneumoperitoneum? In the treatment of pulmonary tuberculosis it is the periodic injection of filtered air into the intraperitoneal space, resulting in an elevation of the diaphragms and a lessening of thoracic volume. By virtue of the subatmospheric pressure present in the intrapleural spaces, the diaphragms are readily elevated and the lungs may be collapsed as much as 70 per cent of their original volume (fig. 1). This decrease in lung volume allows the more diseased areas in the lungs to collapse selectively and heal more rapidly, just as they do in pneumothorax. The healing process and duration of therapy appear to parallel, to a large extent, those associated with artificial pneumothorax.

Advantages

1. With artificial pneumoperitoneum, the physiologic relationships of the intrapleural spaces are not materially impaired, and these spaces remain in a functionally active, physiologically subatmospheric state[2]. This is not the case with established artificial pneumothorax, where the normal intrapleural pressure is definitely altered and some thickening of the pleurae invariably takes place. With uncomplicated cases of artificial pneumoperitoneum very little change is seen in the peritoneum[6].

2. Both lungs may be collapsed at the same time with one procedure, thus sparing the patient time and discomfort, and necessitating less effort on the part of the physician.

3. Since the lungs are not collapsed into the opacity of the mediastinum, as is often the case in artificial pneumothorax, the healing process may be observed roentgenographically.

4. Pneumoperitoneum is usually a reversible procedure and can, in contrast to artificial pneumothorax, be discontinued and reinduced as necessary[1a,b,c].

5. Spread of the disease to the contralateral lung appears to be uncommon, since both lungs are partially collapsed.

6. Spontaneous pneumothorax resulting from tearing of pleural adhesions and blebs, or from needle punctures of the lung, does not occur.

7. The formation of broncho-pleural fistulas is avoided.

8. Pleurisy with effusion is rarely seen.

9. Empyema seldom occurs.

10. Non-expansible lungs requiring oleothorax, plombage, thoracoplasty, or unroofing operations are not seen.

11. Perhaps the outstanding advantage of artificial pneumoperitoneum over artificial pneumothorax, as far as the general practitioner is concerned, is the fact that fluoroscopic control is not essential. The operator

5. Statistics supplied through the courtesy of Drs. R. E. Moyer and Peter Galante .

6. Trimble, H. G., Eaton, J. L., and Moore, G.: Pneumoperitoneum in the Treatment of Pulmonary Tuberculosis: Local Effects on the Peritoneum, Am. Rev. Tuberc. 39:528-536 (April) 1939.

simply injects enough air to inflate the abdomen snugly. He need not worry whether he is puncturing the lung, collapsing it too far, or losing the space—any of which complications may occur with artificial pneumothorax.

Technique

There is no need to describe herein the technique of administering *initial* artificial pneumoperitoneum. This procedure, simple as it usually is, is ordinarily performed in the sanatorium, or by experienced chest

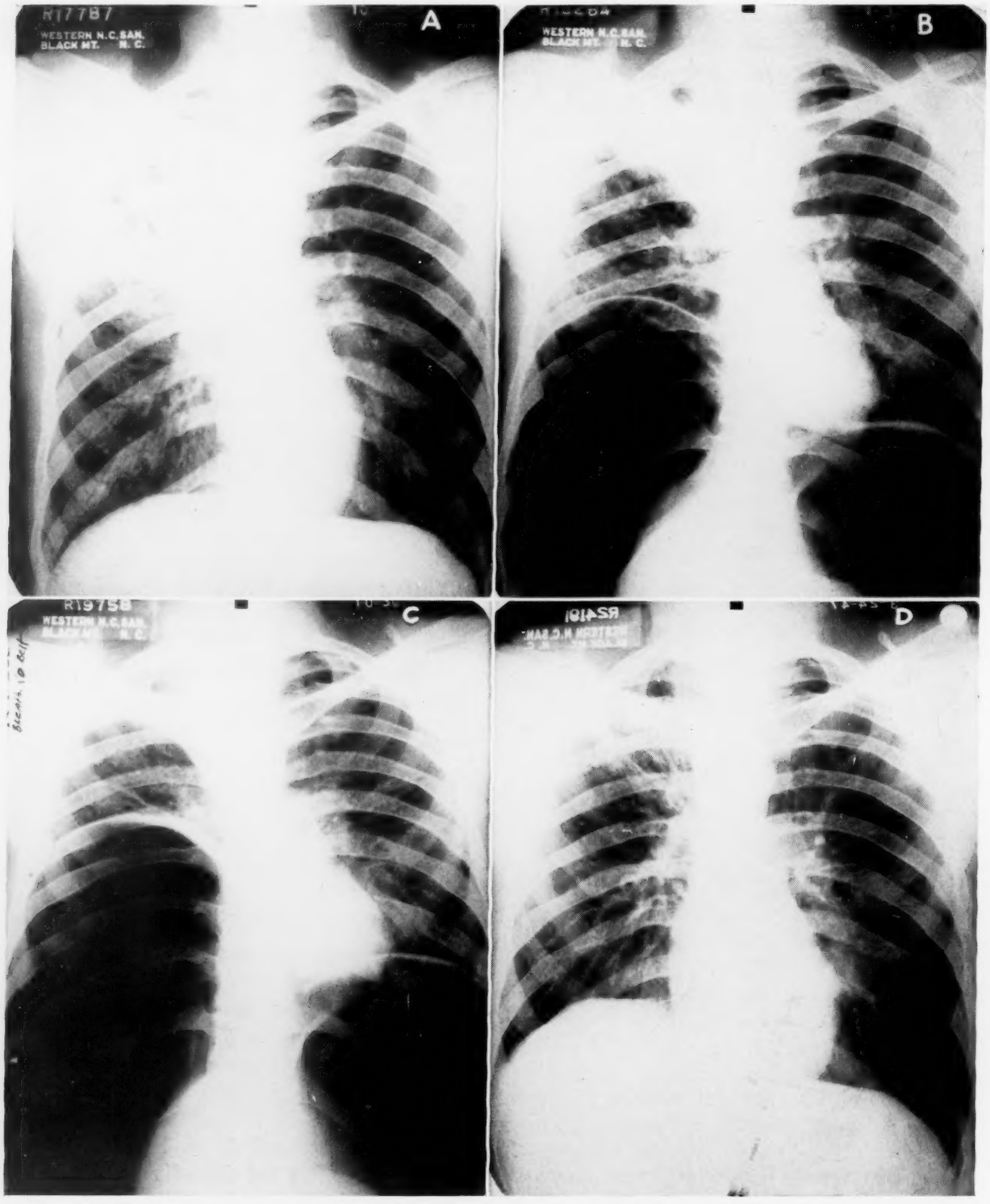

Fig. 1. Representative chest films in a case of far-advanced tuberculosis (a) before, (b and c) during, and (d) after pneumoperitoneum. A right phrenic nerve crush was also done in this case.

physicians in practice. Those physicians interested in this technique may consult almost any one of the references given for details of performing initial pneumoperitoneum. It is the *periodic refill* in established cases which concerns the general practitioner. Any of the usual instruments for administering artificial pneumothorax are quite satisfactory. Among these, the Samuel Robinson apparatus, consisting of two bottles, manometer, suitable adapters, and directional stopcocks, is the most popular method. More recently the Zavod apparatus has been gaining favor in Veterans Administration Hospitals. This consists of a graduated cylinder which administers measured quantities of air under the direct control of a rubber bulb and reservoir. The Davidson apparatus may also be used, but in the hands of most physicians it is less practical than the Robinson and Zavod machines.

With the Robinson-type apparatus satisfactory refills may easily be given, either by using a rubber bulb to force air under slightly increased pressures into the peritoneal cavity, or preferably by elevating the upper water-filled bottle about 50 cm. above the lower bottle. The upper bottle may easily be suspended from a standard used for intravenous medication, or placed upon a platform at that level. To facilitate administration of air in artificial pneumoperitoneum, slightly higher pressures are required than those needed for artificial pneumothorax. The volume of air given at each refill is larger, averaging about 900 cc. of air weekly in established cases. Sufficient air is usually given to produce the pressures found suitable for each individual case in the sanatorium prior to discharge.

The abdominal site for needle penetration has, in established cases, already been determined, and the practitioner can of course use this site. This is usually in the left upper abdomen at the margin of the rectus muscle, about 4 cm. below the costal margin. The technique of skin preparation is identical with that for artificial pneumothorax: that is, the skin is painted with antiseptics such as alcohol and tincture of merthiolate or metaphen. Most patients prefer no local anesthetic, because it requires an additional needle puncture and provides an added chance for introducing infection. One per cent procaine hydrochloride, however, infiltrated at the site of puncture, provides suitable anesthesia for sensitive patients. Patients complain of operators who introduce the needle cautiously and hesitantly. A simple, decisive thrust of the needle through the abdominal wall into the established intraperitoneal space is the preferred technique. In established cases there is an ample, air-filled intraperitoneal space and one need not fear penetration of the abdominal viscera. Ordinary pneumothorax needles are quite satisfactory for pneumoperitoneum refills.

The intervals between refills in established cases range from one to two weeks. Adjustable abdominal binders fitted at the sanatorium appear to lengthen the time interval between refills, since they may be tightened to take up the slack resulting from gradual absorption of air. These binders, however, are not ordinarily necessary.

It is not the purpose of this paper to confuse the reader with unnecessary details. Realistically, anyone who can give pneumothorax refills satisfactorily can, after a little practice, give pneumoperitoneum refills with ease. Physicians who are in doubt as to their technique are encouraged to visit any of the state sanatoria and observe the various techniques. Those physicians who have some difficulty in correctly administering difficult pneumothorax refills will find the average pneumoperitoneum refill much easier.

Complications

Anyone administering artificial pneumoperitoneum should be familiar with its possible complications, even though these are much less frequent than those seen with artificial pneumothorax.

1. *Air embolism* is the most serious complication. It seldom occurs in the hands of careful, experienced operators, and is inexcusable in established cases.

2. *Peritonitis,* whether tuberculous, pyogenic, or otherwise, is a serious complication. It occurs in about 1 per cent of cases—not nearly so frequently as pleural empyema complicating artificial pneumothorax. When it occurs, all the purulent fluid should be withdrawn as completely as possible, the pneumoperitoneum abandoned, and appropriate chemotherapeutic or antibiotic therapy instituted.

3. *Sterile peritoneal effusions* occur in about 8 per cent of cases at some time or other during the course of therapy. They

usually do not impair the effectiveness of the treatment, but they may necessitate paracentesis.

4. *Peritoneal adhesions* may be seen roentgenographically in about 71 per cent of the cases[1a]. In the great majority they cause no trouble, but in some cases they may cause pain or prevent satisfactory elevation of the diaphragm.

5. *Hernias*—inguinal, femoral, umbilical, rectus sheath, and diaphragmatic—may be seen. Usually the external hernias may be adequately controlled with trusses during the course of therapy.

6. *Subcutaneous emphysema* may occur in the hands of inexperienced operators. It results usually from failure to introduce the needle deeply enough, and it is rarely serious.

7. *Penetration of abdominal viscera* may occur in rare cases, but again such a complication is highly unlikely in carefully administered pneumoperitoneum.

8. *Other less frequent complications* such as acute appendicitis, cardiac embarrassment, pregnancy, pain, dyspnea, hemoptysis, rupture of the diaphragm, pleurisy, pericarditis, and wheezing may occur, but these are rarely seen in established cases.

Conclusion

In conclusion it is well to bear in mind that, despite very favorable and promising advances against tuberculosis on the preventive, immunologic, chemotherapeutic, and antibiotic fronts, bed rest, nutrition, and collapse therapy are still the standard and accepted methods of therapy which have arrested many thousands of cases in the past. Even assuming that in the future a specific drug against the tubercle bacillus may be discovered, artificial pneumoperitoneum, a recent and most promising method of collapse therapy, will undoubtedly be used for many years to come as an adjunct to closure of cavities.

Summary

1. Artificial pneumoperitoneum has been shown to be an acceptable and very promising method of collapse therapy in the treatment of pulmonary tuberculosis.

2. Artificial pneumoperitoneum is rapidly becoming the most popular method of collapse therapy in North Carolina, where it is now the method employed in about 50 per cent of all cases in which collapse therapy is used in all state and federal sanatoria.

3. Many patients discharged from these sanatoria are requiring air refills in various sections of the state.

4. General practitioners who give artificial pneumothorax refills should familiarize themselves with a simple technique of administering artificial pneumoperitoneum refills in the office.

5. Despite recent favorable advances against tuberculosis on the preventive, immunologic, chemotherapeutic, and antibiotic fronts, collapse therapy, including artificial pneumothorax, artificial pneumoperitoneum, and thoracoplasty, is still essential for proper management of many cases.

THE PRINCIPLES OF THE PNEUMOPERITONEUM TREATMENT OF PULMONARY TUBERCULOSIS

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This report is intended primarily to review the subject of artificial pneumoperitoneum in the treatment of pulmonary tuberculosis for the benefit of physicians of North Carolina who are seeing increasing numbers of patients discharged from sanatoria on this form of therapy. Some recent advances in physiologic theory and in the indications for pneumoperitoneum are also presented.

This subject was recently reviewed from the standpoint of history, results reported in the literature, technique, complications, and results in 710 cases seen over a ten-year period[1].

Technique

The administration of pneumoperitoneum is technically quite simple, being both less difficult and less dangerous than artificial pneumothorax. Injections are given at a site about 1½ inches to the left of and below the umbilicus. Subsequent treatments are frequently given in the left upper quadrant after a space is created.

After local skin antisepsis and infiltration with 1 per cent procaine, further procaine

1. Mitchell, R. S., Hiatt, J. S., Jr., McCain, P. P., Easom, H. F. and Thomas, C. D.: Pneumoperitoneum in the Treatment of Pulmonary Tuberculosis, Am. Rev. Tuberc. 55: 306-331 (April) 1947.

infiltration is carried out to include the peritoneum. After breaking the skin with a sharp needle, an 18- or 19-gauge blunt-beveled needle, 1½ to 3 inches long, with an additional opening ground into the shaft near the point on the long side, is inserted at right angles to the skin in a twisting fashion. Penetration of the peritoneum by the needle usually gives a distinct sensation to the operator and localized pain to the patient. Frequently the sensation of puncture of two structures is felt — the posterior rectus sheath before the peritoneum. About 2 cc. of air is injected gently with a small syringe. If the needle is in the free peritoneal space, the injected air is lost and cannot be withdrawn. If the needle is outside the peritoneum, air can usually be withdrawn immediately after it is injected, since it is temporarily in a small, confined space. Further penetration is then made. If air continues to be easily recovered, a new site is chosen.

As soon as it is presumed that satisfactory contact with the peritoneal space has been made, the needle is connected to the tubing of the water-bottle type pneumothorax machine. Manometric fluctuations with breathing occasionally offer further evidence that the needle is in the free peritoneal space. Another extremely valuable guide during air administration is the disappearance of all discomfort during actual insufflation; if soreness or pain accompanies the procedure, one is apt to find later that air has been given in a location other than the peritoneal cavity. The air is given slowly with only a small head of hydrostatic pressure; failure to run in under such low pressure is an indication to choose a new site, since air flows readily and quickly into the free peritoneal space. Because of the possibility of air embolism, no air should be given if bleeding occurs during insertion of the needle nor if pain is felt at the site of injection during insufflation.

The amount of air given at the initial injection in the average case will vary from 400 to 800 cc. Subsequent refills are given at intervals and in amounts dependent upon the tolerance of the patient to the procedure and results being obtained; from 500 to 1500 cc. is the amount usually given at intervals of seven to fourteen days. Elevation of the pneumothorax machine bottle to three feet or so above the level of the patient expedites the inflow of air and has proven a safe procedure in refills. The majority of patients prefer to have refills given without the use of procaine, a sharp needle being used and inserted with a quick thrust. The same general principles are followed as in giving pneumothorax refills.

Intraperitoneal pressures (the pressure measured in the distance between the two fluid levels of the manometer) should not be greater than 20 cm. of water, the average being 12 to 16 cm. Higher pressures are seldom associated with good collapse, since diaphragms which can rise will usually do so without great pressure. An abdominal binder[2] is a valuable adjunct in achieving satisfactory diaphragmatic rise and retaining a normal abdominal contour.

The wide individual variation in tolerance to pressure must be re-emphasized; the tolerance level of each individual is frequently used as a guide to the amount of air given at each refill. Fluoroscopic examination is useful before each refill. If pneumoperitoneum is not beginning to produce the desired results within two or three months, or if it is poorly tolerated, it should be discontinued.

It is our present opinion that a satisfactory pneumoperitoneum should be continued at least six to twelve months longer following cavity closure than a satisfactory pneumothorax. The lung should be allowed to re-expand gradually, and the pulmonary status should be closely followed during this time.

Physiologic Considerations

The factors responsible for the beneficial effects of collapse therapy in pulmonary tuberculosis are not clearly understood. In the absence of adjacent pleural adhesions, relaxation of elastic tissue is felt to promote selective collapse in the more diseased tissues, permitting approximation of cavity walls. Bronchial occlusion collapses cavities, preventing reinflation after the remaining air is absorbed. Diminished blood circulation reduces opportunities for hematogenous seeding and promotes fibrosis. Lymph stasis promotes fibrosis and may explain the decrease in constitutional symptoms[3].

2. Now being manufactured especially for this purpose for both men and women patients by Spencer, Inc., New Haven, Connecticut.
3. Pinner, M.: Pulmonary Tuberculosis in the Adult, Springfield, Illinois, Charles C. Thomas, 1945.

These supposed effects of collapse therapy appear to depend to a considerable extent on reduction of pulmonary volume. It has been demonstrated that changing from the erect to the recumbent position reduces lung volume—that is, the so-called functional residual air, which is specifically the amount of air remaining in the lung after a quiet expiration—by 25 to 50 per cent[4]. That the pulmonary relaxation so obtained plays an important part in the effectiveness of horizontal bed rest in pulmonary tuberculosis seems apparent. Spirometric and other studies to determine the extent of further collapse obtained by adding pneumoperitoneum are now being conducted[4].

Adhesions about the diaphragm and within the pleural space may prevent a satisfactory elevation of the diaphragm. If favorably located, however, adhesions occasionly seem to promote selective relaxation in the desired area.

The concentric relaxation seen with a free pneumothorax would seem to promote a more physiologic rest than the vertical relaxation of a good pneumoperitoneum. Two recent papers, however, suggest that, for various anatomic reasons—particularly the plane and size of the draining bronchi[5]—cavities in varying locations may respond best to relaxation in different planes.

Perhaps the most interesting recent physiologic observation is that ventilatory function, as measured by maximum breathing capacity, is not significantly lowered when the lung volume is reduced by pneumoperitoneum[4]. Dyspnea is therefore not necessarily a contraindication to its use, nor a severe or common complication[1]—an advantage not possessed by other forms of collapse therapy.

Electrocardiographic changes after the institution of pneumoperitoneum are not typical or consistent, but frequently reflect the torsion effect of diaphragmatic elevation on the heart. The cardiac apex moves upward toward the left. Elwood, Piltz and Potter[6] found frequent left-axis deviation; Agnello[7] observed slight alteration in the RS and T waves in the three limb leads, and an increase in the interval between the T and P waves; Benatt and Berg[8] found deep Q_3 and flattening or inversion of T_3 quite regularly, and noted that these changes were reversible with descent of the diaphragms. They made the further pertinent observation that vital capacity was not materially affected by the use of pneumoperitoneum.

Indications

The location of the cavity apparently influences results with pneumoperitoneum as it does with other collapse measures. Seven observers have reported that best results are obtained with cavities in the lower third of the lung[9]. We agree with Bennett[10], Gilmore,[11] and McGovern[5b] that cavities in the middle half, especially in the apex of the lower lobe, seem to be most amenable to the vertical relaxation of pneumoperitoneum. Only one author has reported good results in apical cavities[12]. As regards type of disease, we concur with six authors who report that chronic productive disease is unresponsive[9b,13]. Two observers[14] have reported that some danger is associated with the use of pneumoperitoneum in acute exudative disease.

The accumulated experience with pneumoperitoneum is still too limited to permit the formulation of definitive indications . In gen-

4. Wright, G. W.: Unpublished data.
5. (a) Collis, L. J.: On Selecting Treatment for the Patient with Pulmonary Tuberculosis, Brit. J. Tuberc. 41:20-26 (Jan.) 1947; (b) McGovern, B. E.: Preliminary Gradation and Combined Collapse Therapy in Pulmonary Tuberculosis, Tuberculology 8:96-107 (Feb.) 1947.
6. Elwood, B. J., Piltz, G. F. and Potter, B. P.: Electrocardiographic Observations on Pneumoperitoneum, Am. Heart J. 19:206-217 (Feb.) 1940.
7. Agnello, V.: Effect of Pneumoperitoneum on the Electrocardiogram, Ann. Ist. Carlo Forlanini, 2:437, 1938.
8. Benatt, A. J. and Berg, W. F.: The Electrocardiogram in Pneumoperitoneum, Am. Heart J. 30:579-592 (Dec.) 1945.
9. (a) Fowler, W. O.: Pneumoperitoneum in the Treatment of Pulmonary Tuberculosis, Am. Rev. Tuberc. 44:474-478 (Oct.) 1941; (b) McShane, P. I.: Therapeutic Pneumoperitoneum in Pulmonary Tuberculosis, Tuberculology 6: 123-128 (Sept.) 1943; (c) Rilance, A. B. and Warring, F. C.: Pneumoperitoneum Supplementing Phrenic Paralysis, Am. Rev. Tuberc. 44:323-334 (Sept.) 1941; (d) Cohen, R. C.: Tuberculosis of the Lower Lobe, Brit. M. J. 1:662-663 (May 12) 1945; (e) Steen, P.: Basal Tuberculosis, Brit. J. Tuberc. 39:2-23 (Jan.) 1945; (f) Woodford, L. G.: Pneumoperitoneum with Phrenic Paralysis, Dis. of Chest 8: 296-301 (Oct.) 1942; (g) Hawkins, F. S. and Thomas, G. O.: Basal Pulmonary Tuberculosis, with Special Reference to Actiology and Treatment, Tubercle 27:82-87 (July) 1946.
10. Bennett, E. S.: Induced Pneumoperitoneum in the Treatment of Pulmonary Tuberculosis, Journal-Lancet 58:187-190 (April) 1938.
11. Gilmore, D. J.: Pneumoperitoneum with Diaphragmatic Paralysis in the Treatment of Pulmonary Tuberculosis, Dis. of Chest 13:153-161 (March) 1947.
12. Anderson, N. L. and Winn, W. D.: Pneumoperitoneum and Diaphragmatic Paralysis, Am. Rev. Tuberc. 52:380-391 (Nov.) 1945.
13. (a) Crow, H. E.: Pneumoperitoneum: A Form of Compression Therapy in the Treatment of Pulmonary Tuberculosis, J. M. A. Georgia 33:167-173 (June) 1944; (b) Mallick, S. M. K., Malhotra, C. L. and Mohammed, N.: Pneumoperitoneum in the Treatment of Tuberculosis, Tubercle 24:165-173 (Oct.) 1943; (c) Iturriaga, A. P.: Pneumoperitoneum in the Treatment of Pulmonary Tuberculosis, Rev. clin. espan. 5:56-61 (April 15) 1942; (d) Edwards, P. W. and Logan, J.: Pneumoperitoneum in Pulmonary Tuberculosis, Tubercle 26:11-22 (Jan.-Feb.) 1945; (e) Mellies, C. J.: Pneumoperitoneum with an Unusual Complication, J. Missouri M. A. 36:430-435 (Nov.) 1939.
14. (a) Stokes, J. B.: Pneumoperitoneum for Pulmonary Compression, Illinois M. J. 73:137-147 (Feb.) 1938; (b) Disney, E. K.: Induced Pneumoperitoneum in Pulmonary Tuberculosis, M. Bull. Veterans Administration 20:178, 1945.

eral, however, it is felt that pneumoperitoneum should be applied after consideration, and even after failure, of more conventional therapy. However, it seems indicated as a *primary procedure* in preference to all other forms of collapse therapy in the following situations:

(1) *Bilateral cavitation, or unilateral cavitation with fresh active disease on the opposite side.* This category includes the troublesome cases with no conclusive roentgenologic evidence as to which side is the source of positive sputum, and for which bilateral pneumothorax, with all its uncertainties and dangers, was formerly the usual method of treatment. One side may be sufficiently improved by pneumoperitoneum to permit effective pneumothorax or thoracoplasty on the other.

(2) *Acute pneumonic or caseopneumonic lesions, unilateral or bilateral.* Pneumoperitoneum is recommended as a preliminary collapse treatment, to be followed if necessary by more definitive collapse therapy at a later date. Pneumothorax and thoracoplasty, frequently used in desperation, are notoriously dangerous in this type of lesion, and bed rest alone, even under ideal conditions, may be inadequate[15].

(3) *Unilateral cavitation.* Pneumoperitoneum, with or without phrenic nerve crush, is worth a trial of four to six months before resorting to thoracoplasty. It is especially valuable if thoracoplasty is unsuitable because of the location of the cavity, if it is not available, or if the patient refuses operation.

(4) *As a supplement to diaphragmatic paralysis.* Pneumoperitoneum is particularly indicated in the case without appreciable elevation of the diaphragm following interruption of the phrenic nerve. From a theoretical and practical standpoint, however, it may be beneficial in all cases of diaphragmatic paralysis by limiting the paradoxical motion which is felt by many observers to inhibit pulmonary drainage, especially of the lower lobes.

(5) *As a supplement to pneumothorax.* Pneumoperitoneum may rarely cause sufficient relaxation of apical and diaphragmatic adhesions not amenable to pneumonolysis or pneumothorax to complete cavity closure and convert sputum to negative, thus avoiding the drawbacks of a phrenic nerve interruption. It may be particularly useful in the case of partially unsatisfactory pneumothorax complicated by spread to the opposite lung, in which abandonment is fraught with greater danger than continuation.

Pneumoperitoneum is also recommended for consideration in the following special situations:

(6) *To obliterate a pneumothorax space.* When a pneumothorax is unsatisfactory, pneumoperitoneum makes it possible to obliterate the pneumothorax space quickly. Occasionally pneumoperitoneum may reduce the hazard of empyema by obliterating the space of an old pneumothorax which has produced a thickened pleura and non-expansible lung.

(7) *To obliterate a post-pneumothorax empyema space,* with or without bronchopleural or pleuro-cutaneous fistulas; results are possible only in early cases.

(8) *To control pulmonary hemorrhage* when pneumothorax is inapplicable or when the side of the bleeding cannot be determined.

(9) *To prevent postpartum spread of unstable disease.* Immediately after delivery of the placenta—or, if preferred, after a twelve-hour postpartum period — the peritoneal space is filled with air (usually 2000 cc. or more). Pneumoperitoneum is continued in the usual fashion, or diaphragmatic levels are gradually returned to normal over a three or four months' period[16].

(10) *In tuberculosis complicated by bronchial asthma.* Pneumoperitoneum offers a form of collapse which is not particularly prone to produce dyspnea and which can be readily withdrawn if respiratory distress makes it necessary.

(11) *To close tension cavities.* The results of pneumoperitoneum in this situation are admittedly uncertain and unpredictable, but it has occasionally produced cavity closure without danger of complications or permanent collapse. Bronchoscopic examination and suitable treatment of tuberculous endobronchitis, if present, should precede the use of pneumoperitoneum. Pneumothorax is notoriously unsatisfactory and dangerous in

15. Wade, O. L.: Tuberculous Lobar Pneumonia Treated by Pneumoperitoneum and Phrenic Crush, Lancet 1:496-497 (April 6) 1946.

16. (a) Barnes, J.: Artificial Pneumoperitoneum in Pulmonary Tuberculosis and Pregnancy, Lancet 2:976-977 (Nov. 4) 1939; (b) Drury, M. I. and Duffy, J.: Pneumoperitoneum in the Treatment of Pulmonary Tuberculosis, Irish J. M. Sc. p. 504-508 (Sept.) 1944.

the presence of a tension cavity. Monaldi drainage is effective in some hands, but its success depends on the location of the cavity, and to a great extent on the skill of the operator and on prolonged, painstaking postoperative care; it is usually only a preliminary to thoracoplasty. Thoracoplasty, lobectomy, and pneumonectomy are applicable in very selected cases. Temporary disappearance of tension cavities is commonly observed and is thought to be due to the occurrence of complete, instead of ball-valve, blockage of the bronchus draining the cavity.

(12) *As palliative therapy in far-advanced cases.* The relief from cough, greater ease in raising sputum, relief of toxic symptoms, feeling of well-being, and in particular, the fact that some active treatment is being offered, make the use of pneumoperitoneum in these cases very gratifying. Occasionally, when it is least expected, a patient believed to be hopelessly ill will respond.

Pneumoperitoneum used for these indications helps to prepare patients for major chest surgery, by healing or sufficiently stabilizing disease on one side to permit thoracoplasty on the opposite side.

Data being accumulated on the use of streptomycin in combination with pneumoperitoneum seem to indicate that this is a logical approach to the problem of cavitation not amenable to collapse or streptomycin alone. The drug should theoretically cleanse the lining of cavities, while collapse should permit the walls to approximate and heal during the stage of relatively clean granulation tissue.

Contraindications

(1) *Chronic fibroid phthisis* with old, thick-walled cavities does not respond to pneumoperitoneum any better than it does to other forms of collapse therapy.

(2) *Cardiac decompensation or recent coronary occlusion.* Though no studies have proven it, there is the possibility that pneumoperitoneum, by interference with venous return or torsion of the great vessels, may cause some circulatory embarrassment which could impair the function of a previously damaged heart. There is no evidence in the literature, nor in our experience, that pneumoperitoneum causes circulatory embarrassment in the absence of pre-existing major cardiac disease.

(3) *Tuberculous enteritis.* Some observers report that pulmonary tuberculosis, when treated with pneumoperitoneum in the presence of clinically active tuberculous enteritis, may fail to improve or may even become worse[1,14].

(4) *Tuberculous adhesive peritonitis* is not a positive contraindication, but there is danger of reactivating the peritonitis by puncture of a viscera during refills. Furthermore, adhesions may prevent adequate elevation of one or both diaphragms.

(5) *Hernia.* Any abdominal hernia, unless properly supported by a truss, is a contraindication.

(6) *Recent abdominal surgery.* Pneumoperitoneum may be instituted six to eight weeks after uncomplicated operative procedures.

Complications

A summary of the complications reported in the literature and those observed in our own experience has been reported[1].

The previous report of six deaths from air embolism in pneumoperitoneum needs correction and addition. The case reported by Rilance and Warring[9c] was apparently the same as that reported by Warring and Thomas[17]. To the other five deaths previously reported[1,18], six more must now be added[19], making a total of eleven from all available sources. No other deaths directly attributable to pneumoperitoneum therapy have been found. From the data reported regarding these deaths, it appears that the air has frequently been forced into a solid organ, often the liver, under considerable pressure, or that the administration of air has been continued in the presence of bleeding. Such catastrophes should not occur if low hydrostatic pressures are used and if proper care is taken in selecting the site for injection. Another location should be sought

17. Warring, F. C., Jr. and Thomas, R. M.: Spontaneous Air Embolism Observed in Case of Pneumoperitoneum, Am. Rev. Tuberc. 42:682-687 (Nov.) 1940.
18. (a) Trimble, H. G. and Wardrip, B. H.: Pneumoperitoneum in the Treatment of Pulmonary Tuberculosis, Preliminary Report, Am. Rev. Tuberc. 36:111-118 (July) 1937; (b) Harrell, C. L.: Pneumoperitoneum in the Treatment of Pulmonary and Abdominal Tuberculosis, Dis. of Chest 6: 273-277 (Sept.) 1940; (c) Simmonds, F. A. H.: Air-Embolism and Pneumomediastinum in Artificial Pneumoperitoneum, Lancet 1:530-533 (April 13) 1946; (d) Roche, G. and Giron, J.: Fatal Accident in the Course of Pneumoperitoneum Therapy, Rev. de la tuberc. 9:115, 1944.
19. (a) Aslett, E. and Jarman, T. F.: Reaction after Pneumoperitoneum Treatment, Lancet 1:304-305 (March 10) 1945; (b) Case, J. T.: A Review of Three Years' Work and Articles on Pneumoperitoneum, Am. J. Roentgenol. 8:714-721 (Dec.) 1921; (c) Browne, N. C. and Corrigan, F. L.: Tuberculous Cavities and Pneumoperitoneum, Irish J. M. Sc. pp. 697-702 (Dec.) 1945.

if bleeding occurs.

The incidence of cases in which abdominal fluid forms is probably greater than recorded. Small amounts of fluid are hard to detect in pneumoperitoneum, whereas the opposite is true in pneumothorax. When patients are fluoroscoped in the upright position, fluid levels may be seen in the free peritoneal space. In most instances these prove to be transitory. Pneumoperitoneum may be continued in the presence of fluid unless it becomes quite extensive. If aspiration is required, replacement of the fluid with air is indicated. It is not clear whether the fluid is indicative of peritoneal irritation by air or is the result of tuberculous peritonitis. The diagnostic criteria and studies, and the management of the patient should be the same in cases of pneumoperitoneum with fluid as in cases of pneumothorax with free pleural fluid.

It is worth re-emphasizing that no serious complications have occurred as a result of penetration of the gut. Extensive subcutaneous emphysema, with no serious sequelae, may occur when air is inadvertently injected into the extraperitoneal tissues.

Summary

1. The technique of administering and continuing pneumoperitoneum therapy has been reviewed.

2. The physiologic effects of pneumoperitoneum have been considered, particularly in the light of recent findings.

3. Indications and contraindications for the use of pneumoperitoneum are suggested.

4. The common and serious complications of pneumoperitoneum have been mentioned.

Conclusions

1. Pneumoperitoneum is a safe, reversible, mild form of collapse therapy for pulmonary tuberculosis. It is not likely to produce severe dyspnea.

2. Pneumoperitoneum exerts its beneficial effect in pulmonary tuberculosis chiefly through pulmonary relaxation produced by reduction of lung volume.

3. Pneumoperitoneum is a useful addition to the program of collapse therapy for pulmonary tuberculosis.

PULMONARY RESECTION FOR TUBERCULOSIS

JULIAN A. MOORE, M.D.

ASHEVILLE

Resection of a tuberculous lung in whole or in part is a relatively new method of treating tuberculosis, even though it was done successfully by Tuffier[1] in 1891. It is not a logical procedure, because tuberculosis is a generalized disease, and removal of the main focus does not necessarily insure the patient's immediate or eventual recovery. There are a number of patients, however, with advanced disease and with various complications who do not respond to the usually accepted methods of collapse therapy. This group of patients, in whom all other measures have failed, have stimulated surgeons to resect the lung in an attempt to cure the disease.

Indications

At present the indications for resection of the tuberculous lung are limited to the following types of cases:

1. Thoracoplasty failures
2. Basal disease that has failed to respond to more conservative measures
3. Endobronchial disease which produces blocked cavities or tension cavities
4. Endobronchial disease which produces bronchiectasis and pulmonary suppuration
5. Tuberculoma
6. The so-called "destroyed lung," which is extensive caseous disease with multiple cavitation.

It is essential that the contralateral lung be comparatively free of disease, and any focus which may have been present in this lung should be arrested, or at least under control. It is also imperative that the patient's vital capacity, after the diseased portion has been resected, shall be adequate to carry on with ordinary physical activities. I can see no sensible reason why the operation should be attempted in patients who have had bilateral disease and whose vital capacity is so low that pulmonary resection leaves them hopeless respiratory cripples, even though it may convert their sputum to negative.

1. Tuffier, M.: Pleurolysis in Pleuro-Pulmonary Surgery, Arch. med.-chir. de l'app. respir. 1:28-45 (Feb.) 1926.

If pulmonary resection can be done with a low operative mortality and morbidity rate, and if the late results prove to be good, then I am sure that the indications for resection will be greatly extended.

Mortality

In 1942 Thornton and Adams[2] collected 29 cases of pneumonectomy and 46 cases of lobectomy from the literature, to which they added 5 cases of their own. The majority of these cases were done by the tourniquet technique. The mortality rate from the pneumonectomies in this group was 44.83 per cent, and the results were satisfactory in only 41.38 per cent of the cases. For the lobectomy group the mortality rate was 25.49 per cent, and 68.62 per cent of the patients had satisfactory results.

In March, 1947, Overholt and his associates[3] reported their experiences with pulmonary resection for tuberculosis. In the past two years lobectomy was performed on 35 patients, with an operative mortality of 6 per cent, and pneumonectomy was performed on 69 patients, with an operative mortality of 13 per cent. In the same paper they showed that their previous mortality rate had been 9 per cent for lobectomies and 22 per cent for pneumonectomies. Thus, during a period of twelve years, they had brought the operative mortality to a reasonable figure.

Improvements in Technique

The improvement in the operative mortality rate has been due, in my opinion, to three important factors. The first is the development of the individual ligation technique for lobectomy and pneumonectomy. Instead of ligating the hilar structure *en masse*—a procedure which resulted inevitably in a high percentage of bronchial fistulas and empyemas—the surgeon now dissects out the pulmonary vessels and ligates them separately. The bronchus is cut cleanly and closed carefully with fine silk or stainless steel sutures, and the stump is covered with a pleural flap. Immediately, with the development of this technique, the complications of pleural infection and bronchial fistulas were reduced considerably. Fortunately, in most tuberculous patients the hilar structures are free, and such a technique is not difficult to carry out.

Of secondary importance in reducing the operative mortality and morbidity rate was the realization that the spilling over of infected sputum into the bronchial tree of the contralateral lung was the chief factor responsible for spread of the disease. The anesthetist must at all times keep the airway unobstructed, and the sputum must be frequently aspirated through the intratracheal catheter. At the end of the operation bronchoscopic aspiration of the bronchial tree is helpful. Some operators have devised and used intratracheal catheters with a balloon attached, by which the bronchus of the contralateral lung can be blocked off and protected against contamination. Moody[4] at Duke has devised a balloon which can be inserted into the bronchus on the diseased side and prevent infectious material from spilling over. More important than these methods is the position of the patient during operation. Overholt[3] introduced the prone or face-down position. With the patient in this position, sputum gravitates toward the mouth and the anesthetist can keep the tracheobronchial tree empty. In addition, Overholt uses a paravertebral block anesthesia combined with analgesia, so that the patient can voluntarily cough out the sputum during the operation. I use general anesthesia and place the patient in the face-down position. In my opinion, the position is the important contribution that Overholt has made to the technique of pulmonary resection.

The third most important factor in reducing the complications of intrathoracic operations has been the discovery and use of the antibiotic agents—the sulfonamides, penicillin, and streptomycin.

The most important of these drugs, so far as tuberculosis is concerned, is streptomycin. Both experimental and clinical studies have shown that streptomycin does have a bacteriostatic effect on the tubercle bacillus. At the Veterans Hospital at Oteen, North Carolina, certain clinical studies with streptomycin are being carried out. One of these studies is to determine whether streptomycin will reduce the incidence of spreads and empyema during resection of the lung for tuberculosis. These studies are not complete, but our ex-

2. Thornton, T. F., Jr. and Adams, W. E.: Resection of Lung Tissue for Pulmonary Tuberculosis, Surg., Gynec. & Obst. 75:312-327 (Oct.) 1942.
3. Overholt, R. H. et al.: Pulmonary Resection in the Treatment of Pulmonary Tuberculosis, Am. Rev. Tuberc. 55:198-222 (March) 1947.
4. Moody, J. D., in discussion at Twenty-Seventh Meeting of the American Association for Thoracic Surgery, Surgery 22:274 (Oct.) 1947.

perience in 25 cases indicates that the use of streptomycin does reduce the incidence of spreads and empyema, and has played a large part in lowering the mortality and morbidity rate. It will take a larger experience to establish this fact, and it will take several years to determine whether the late results can be improved.

Conclusion

At present, pulmonary resection for tuberculosis can be done without a prohibitive mortality rate. It offers a reasonable chance of cure to many patients in whom everything else has failed. If the late results prove as satisfactory as the immediate results, the indications for pulmonary resection will be greatly extended.

A HIGH TEMPERATURE IN PULMONARY TUBERCULOSIS WITH EVENTUAL ARREST OF THE DISEASE

A Case Report

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LOUISVILLE, KENTUCKY

A few weeks ago a girl returned to the sanatorium for her periodic check-up. On entering the examination room she asked, "Did you read in the paper about the tuberculosis patient who the doctor claimed had the highest temperature ever recorded in tuberculosis, 107?" She continued, "I guess he didn't know about me, as I had 112." Why she claimed a temperature of 112 I do not know, as the highest recorded in her case was 108.6 F. by mouth. As far as I have been able to ascertain, this is the highest temperature ever recorded in pulmonary tuberculosis with final recovery from the episode. It is quite probable that her temperature went higher than this, but we were too busy with the patient to think of taking her temperature frequently. I believe that Paul McCain would have been interested in this case, and therefore I wish to report it as my contribution to this memorial issue of the NORTH CAROLINA MEDICAL JOURNAL.

Report of Case

The patient, an unmarried female, was admitted to the sanatorium one day after she stopped work as a stenographer. She was 22 years old, 5 feet, 6 inches tall, and of a small frame, weighing only 98 pounds. Her father had died of tuberculosis in May, 1938, two months prior to the patient's admission. Her mother had taken many months of bed rest for tuberculosis, and her disease was considered arrested. The patient's paternal grandmother had died of tuberculosis. Otherwise the family history was negative.

In childhood she had the usual diseases, including measles and scarlet fever. During adolescence she had pneumonia, many colds, and hay fever. A year previous to admission she was operated on for appendicitis, and had phlebitis following the operation. For years she had suffered from chronic constipation, but her menstrual and renal history was negative. The history of her present illness began only two months before admission, when she noticed that she became easily fatigued and found that she had lost a little weight. During this time a productive cough developed and she began to have a slight fever, first noticed a few weeks prior to admission.

Physical examination showed a frail, highly nervous girl, but was otherwise essentially negative except for her lungs. Chest examination disclosed the physical signs of bilateral active pulmonary tuberculosis. The x-ray showed a moderate amount of mottling in the second right interspace, extending behind the third rib; the rest of the right lung appeared to be clear. The left lung showed infiltration from the second rib to the apex, rather dense behind the first rib, but with no definite cavity; the rest of the lung was clear. Sputum examination was negative. The sedimentation rate was 15 mm. in an hour, the blood count normal, Kahn negative, urinalysis negative. The diagnosis was chronic pulmonary tuberculosis, moderately advanced, bilateral.

One would expect that a case of this sort could be arrested with bed rest and pneumothorax on the left side. Such, however, did not prove to be the case. Before her disease was controlled, the patient had had a bilateral pneumothorax, intrapleural pneumonolysis, phrenic crush, bronchoscopy, and a four-stage thoracoplasty. During the course of her disease she had a probable brain complication which doubtless caused

her excessively high temperature.

Collapse therapy was begun in August, 1938, with artificial pneumothorax on the left. A complete collapse could not be obtained, as the apex of the lung was adherent and intrapleural pneumonolysis was not possible. Sufficient compression seemed to be present, however, after crushing of the left phrenic nerve, and pneumothorax was continued. Meanwhile, the disease in the contralateral lung cleared almost completely. The patient gained 8 pounds in weight, and never had a positive sputum.

She was discharged from the sanatorium as a quiescent case on February 6, 1939, to continue bed rest at home and to receive refills at intervals of two weeks from a local physician. During the next fifteen months the patient returned every three months to the sanatorium for check-ups, and it was found that she was doing very well, although the x-ray showed that a slight amount of infiltration persisted in the right lung. Her only complaint was a rather severe reaction after refills. This reaction was controlled by her local physician, who gave rather small amounts of air at more frequent intervals. The girl felt so well that she started to work against medical advice.

Upon her return for a check-up on May 24, 1940, it was found that a new focus of infection had appeared in the first interspace, outer zone, right lung; there was only a suggestion of infiltration in the second interspace, where the disease in this lung had first appeared. The rest of the lung was clear. The left pneumothorax still appeared to be effective in spite of the apical adhesions.

She was re-admitted to the sanatorium on July 7, 1940, and bilateral pneumothorax was instituted, the collapse of the right lung being made effective by intrapleural pneumonolysis. Her sputum continued to be negative for tubercle bacilli.

During the next few months the patient did very well, and it was hoped that her disease would eventually become arrested without any further complications. In October, 1940, she developed a boil on the buttocks. This was incised and healed promptly, giving her only a short time of discomfort. At this time she felt so well that it was difficult for her to stay in bed. She had a constant urge to go visiting, and the nurses frequently had to chase her back to bed.

On December 8, 1940, she complained of pain in the sternal region which radiated around the left side of the chest to the spine. It was so severe that it was only partially relieved by codeine and strapping of the chest. This pain persisted in lessening degrees for a week. Two days after the onset of this pain, however, she began to have pain in the right side, which was found to be due to fluid in the right pleural cavity. It was relieved by aspiration of the fluid. Concurrently, a severe frontal headache developed, radiating to the frontal sinuses and maxillary region, and lasting thirty-six hours. It was attended with nausea and vomiting. She began to run a fever ranging from 101 to 104.6 F., with a pulse averaging 120. Her headache returned with added severity, and could be relieved only slightly with ice caps, codeine, and sodium luminal.

In January, 1941, the fever began to range from 97 to 101, with a relatively slow pulse, averaging 82. This temperature and pulse range continued for the next twenty days, and the severe headaches persisted. On January 21 the temperature reached 105.2 F., with a pulse of 120. On the morning of January 22 the thermometer registered 98, with a pulse of 100. At 5:30 p.m. the temperature was recorded at 103.4 F., and at 8:00 p.m. at 108.6 F., with a pulse of 120.

At the time this high temperature was registered the patient was fully conscious, and before the thermometer had been in her mouth for three minutes she removed it and cried, "My head is killing me!" The thermometer used was calibrated only to 108 F., and as the mercury was approximately 0.6 of a degree above this point, the reading of 108.6 F. was recorded. Had the temperature been taken by rectum with a thermometer capable of recording the temperature, one can only conjecture what the reading would have been. Perhaps this girl is right in claiming a temperature of 112.

During this episode numerous laboratory studies were made. The sputum continued to be negative, and all tests for typhoid, undulant fever and tularemia were reported negative. Blood counts were essentially normal, the white cells ranging from 5,500 to 9,000, with a normal differential, except for an increase in monocytes, occasionally to as high as 10 per cent; the red cell count averaged 3,800,000, and the hemoglobin 78 per

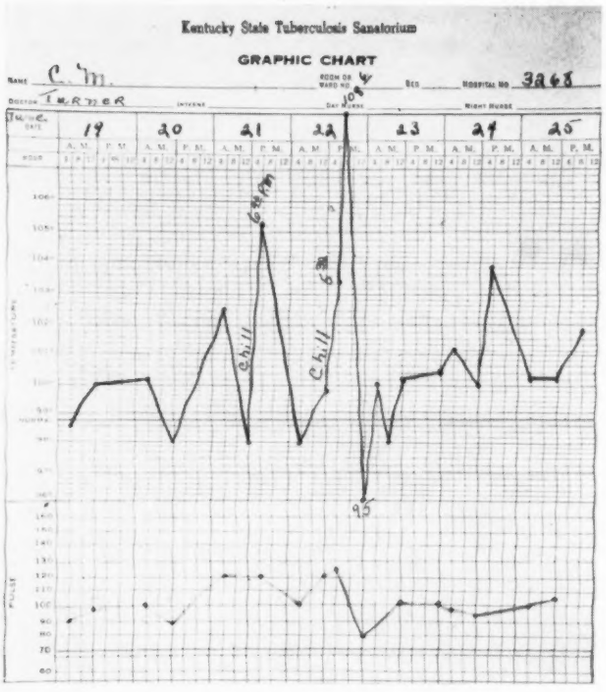

Fig. 1. A graphic chart of the patient's temperature and pulse during the week that the high temperature was recorded.

cent. The spinal fluid contained no globulin, no cells, and no tubercle bacilli. Examination of feces was negative for parasites and tubercle bacilli.

Dr. Glen Spurling, brain specialist, and Dr. Murray Kinsman, internist, were called in consultation. Neither expert could find any definite cause for the high temperature. Incidentally, it should be recorded that the eyegrounds were normal, and that x-rays of the cranium and spine were negative.

At this time the patient was not expected to live. Pneumothorax treatments had been discontinued and the lungs were allowed to re-expand. The morning after the temperature of 108.6 F. was recorded, the reading was 95 F. For the next four and a half months the temperature ranged between 102 and 104 F., with a relatively slow pulse, until on June 1 temperature and pulse became normal. During this time severe headache persisted, but gradually became less intense and finally disappeared. On June 1 the episode was concluded. Temperature and pulse were normal, and the patient was without symptoms. X-ray showed the lungs re-expanded, with no evidence of clinical disease. The patient was again discharged from the sanatorium as a quiescent case on June 16, 1941.

Against advice the girl once more started working, and reactivation occurred in her left lung after a period of two years. She was again admitted to the sanatorium, for the first time with a positive sputum. Thoracoplasty was performed in four stages, and for the last two years her disease has been considered arrested.

The patient is at home doing light work. She is handicapped by a spinal deformity, which we feel is due to her being so restless that she could not stay on her pillow following the thoracoplasty operations.

Comment

The cause of the high temperature in this case was not definitely ascertained. It recalled, however, another unreported case seen at this sanatorium about ten years ago in which the temperature reached 107 F. That patient, a middle-aged male, also had severe headaches. The spinal fluid, however, was under pressure, and a few tubercle bacilli were present. The pulmonary tuberculosis was definitely arrested. Dr. Spurling, who was called as consultant, concluded that there was probably a tuberculoma of the brain situated near the fourth ventricle. He operated and found a few tubercles within the fourth ventricle; no other tubercles were seen. The patient died a few days after recovery from the operation.

Judging from this experience, we believe that the patient under discussion probably had a few isolated tubercles in the heat center of the brain which eventually healed.

Finally, I wish to state that the seemingly effective left pneumothorax should probably have been abandoned early and a thoracoplasty done. This perhaps might have prevented the patient's unfortunate experiences, and the thoracoplasty on the right side might not have been necessary.

Summary

A case of pulmonary tuberculosis is reported in which a temperature of 108.6 F. was recorded. The patient is now living, six years after the episode, with her pulmonary disease arrested.

When compared with some other diseases, the purchase price of control of tuberculosis may be considered a bargain. This is so because we know its cause. We know how it is spread. We know how to prevent it, and we know how to treat it. Moreover, it costs pennies to control it, and dollars to tolerate it.—Robert E. Plunkett, M.D., N.Y. Dept. Health, Mar., 1946.

REHABILITATION IN THE TREATMENT OF TUBERCULOSIS

C. D. THOMAS, M.D.

BLACK MOUNTAIN

The treatment of tuberculosis is based on rest and isolation. Physical rest is obtained by placing the patient in bed, and mental rest comes with education concerning his disease and assistance in meeting his social and financial problems. Isolation is best obtained in a sanatorium, where the necessary facilities are provided. The sanatorium also has facilities for all forms of collapse therapy. These include pneumothorax, pneumoperitoneum, phrenic operations, and thoracoplasty. Collapse therapy is of great help in arresting the disease, but best results are obtained where it is used along with bed rest. Even under the best circumstances, bed rest may be necessary for months or even years to bring about arrest of the disease.

Because such long periods are necessary for recovery, the psychologic management of patients is often as difficult as their physical treatment. The mental shock of receiving a diagnosis of tuberculosis is severe. With it come thoughts of permanent disability, a complete disruption of one's way of living, an indeterminate period of inactivity and isolation, and even death.

Before Admission to the Sanatorium

Rehabilitation can be started at the time the diagnosis is made. The need for bed rest, sanatorium treatment, and isolation can be explained, and at the same time the hope of recovery can be instilled. Almost all patients will in a short time respond with a feeling of optimism and cooperation. As a waiting period is usually necessary before the patient can be admitteed to a sanatorium, many of the patient's most pressing problems can be settled during this time, with the help of local agencies such as the public health and welfare departments. The care of the other members of the family can be arranged, and financial assistance worked out where it is necessary. The patient enters the sanatorium hopeful of recovery and ready to settle down and do everything possible to get well.

During the Period of Sanatorium Treatment

In the sanatorium rehabilitation has often been entirely overlooked or its importance disregarded. A great deal of thought has been given to the development of sanatorium routine and to the various procedures carried out in collapse therapy, but the psychologic changes which occur during the long periods of physical inactivity have been largely disregarded.

The benefits of a program of rehabilitation are both mental and physical. Programs for education or entertainment are followed by improvement in morale. Permitting the patient some physical activity, even though limited, is evidence that improvement has taken place and that chances for recovery are greater. The patient is relieved to a great extent of the boredom of an otherwise unvaried period of inactivity.

As a tuberculous patient begins to improve, his return to health will be hastened by an increase in his physical activities. At this time his interest should be pointed either directly or indirectly toward some job objective, so that he may gain the mental assurance which comes to those with a definite capacity for earning a livelihood. The aim of treatment should not be merely to arrest the patient's disease, but also to rebuild his confidence in himself and improve his tolerance for physical activity to the point where he can do some sheltered work, take additional skilled training, or adjust to the responsibilities of a near-normal social life.

A program of rehabilitation should consist of social service, occupational therapy, education, and vocational counseling.

Social service

Social service brings assistance to the patient in solving his personal problems, both social and financial. If the patient requires a long period of sanatorium treatment, arrangements which have been made for the care of his family may change and new plans may be necessary. The social worker should have a good knowledge of the patient's progress and prognosis, so that she can advise him what to expect and whether the settlement of any difficulties should be on a long- or short-term basis. This assistance with troubles at home will often prevent patients from leaving the sanatorium against advice. By interviews with the patient's family, the social worker can help them to understand his problems.

Occupational therapy

Occupational therapy is any activity, either mental or physical, which is prescribed and directed for the purpose of aiding in recovery from illness. Under this definition, the scope of occupational therapy is limitless. It has special value in the treatment of tuberculous patients. For the guidance of the therapist, the patients are divided, according to the activity they are permitted, into five groups, similar to those outlined by Bobrowitz[1] and Aitken[2]:

Activity 0—Absolute bed rest; no occupational therapy.

Activity 1—Absolute bed rest; reading, writing, handwork for one hour per day.

Activity 2—Bed rest except for bathroom privileges; reading, writing, handwork in bed three hours per day.

Activity 3—Limited time out of bed as prescribed; reading, writing, handwork in bed three hours per day.

Activity 4—Limited time out of bed; meals in dining room; walking exercise as prescribed, which may be taken as shop work up to one hour per day.

Activity 5—Full time up except for one and a half hours' rest in the morning and two hours' rest in the afternoon. Walking exercise as prescribed, which may be taken as work in shop up to two hours per day.

In some sanatoria, patients are kept until they are able to work four to six hours per day, and on their return home, to take regular employment. In many others, however, because of a shortage of beds they are sent home on more limited activity to make room for someone who needs sanatorium care.

The arts and crafts which are taught are almost limitless. For those in bed, there is needlework, crocheting, knitting, hand looms; in the shop there is leatherwork, woodwork, silver and many more. Some of these activities may point toward an occupational objective, while others are purely for recreation and to increase the patient's tolerance for physical activity.

Education

There are in every sanatorium patients who have had their education interrupted. A well-qualified teacher can, by spending a short time with each of them every day, help them to carry on at least a part of their school work, so that they will not be so far behind when they return to school. There is also a group of patients who are illiterate. Many can be interested in learning to read and write. When they are able to read their letters from home, and can write in reply, they feel as though they have accomplished one of the greatest things possible. There are others who wish to increase their knowledge on some subject; with guidance, they can use their period of sanatorium treatment to improve their minds with something of real value. The librarian can cooperate by guiding the patient's interest toward books with educational value or with a bearing on his occupational objective, in addition to books which are purely entertaining.

Vocational counseling

The vocational counselor is a person who has had special training in job placement, particularly of the handicapped. He confers with patients who are improved, and usually are on activity 4 or 5. After obtaining their occupational history, he gives them various adaptability tests to determine the type of work for which they are best suited. Then, after conference with the physician, a job objective is selected which would be within the physical abilities of the patient.

After Discharge

After a patient leaves the sanatorium, a period of three to six months at home is usually required for him to become adjusted to living with his family under normal conditions. Repeated examinations are made during this time, and when he is found to be in condition to start work, he again confers with the vocational counselor. He is then started in training on his new job objective, or is placed on a job which he already knows. In some cases, of course, he may continue his education. The plan chosen for his training or work must be approved by the physician.

1. Bobrowitz, I. D.: Vocational Therapy in the Sanatorium, Am. Rev. Tuberc. 45:400-409 (April) 1942.
2. Aitken, A. N.: (a) The Broad Scope of Occupational Therapy for the Tuberculous, read at the Annual Meeting of the Western New York Occupational Therapy Association, May 6, 1941; (b) The Rehabilitation Service of the Niagara Sanatorium, Livingston, New York, The Livingston Press, 1944.

Conclusion

The complete rehabilitation program cannot always be provided by a sanatorium, but some part of it should be possible. If only one worker may be employed, he should be able to take over more than one feature of the program. In every community, there are people who are interested in giving of their time and talents to assist with such a program on a volunteer, part-time basis. They only want to know they are wanted and needed, and that there is someone at hand to guide their efforts.

The entire program of diagnosis, treatment, and rehabilitation must be well integrated, so that the therapeutic value of the various aids can be fully utilized and so that the patient does not become over-optimistic as to his progress, but is guided along as rapidly as his condition allows.

A rehabilitation program such as has been outlined has been started at the Western North Carolina Sanatorium through the assistance of the North Carolina Tuberculosis Association and the North Carolina Department of Vocational Rehabilitation. Though it is of only short duration and though all the workers needed have not yet been obtained, its value can already be seen. Fewer patients are leaving against medical advice, and there is less dissatisfaction. As it is continued, further evidence of its value will be a reduction in the number of relapses among discharged patients because of poorly chosen work.

The patient with tuberculosis upon admission to a hospital becomes an individual with a broken body and disturbed mind and not just a pair of lungs sent in for repairs. The sanatorium is a place where patients' lives are carefully regulated. The rest periods are not interrupted as they would be at home by well-meaning but ill-advised friends. The X-ray equipment needed to record the course of the disease and as a guide in treatment is always at hand.—Henry D. Chadwick, M.D. and Alton S. Pope, M.D.; The Modern Attack on Tuberculosis, The Commonwealth Fund, Revised, 1946.

For over sixty years it has been known that the tubercle bacillus is the cause of tuberculosis, and that it should be looked for in the sputum of patients with respiratory infections has become axiomatic. Notwithstanding this common knowledge, physicians very often lose valuable time treating tuberculous patients for colds, bronchitis, or asthma, and they may even have tonsils removed because of cough before a specimen of sputum is examined for tubercle bacilli.—Henry D. Chadwick, M.D. and Alton S. Pope, M.D.: The Modern Attack on Tuberculosis, The Commonwealth Fund, Revised, 1946.

THE SEQUELAE OF PULMONARY TUBERCULOSIS

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One of the great paradoxes of medicine is the fact that healing and regeneration are not infrequently responsible for disease conditions which are as bad as the original ailment, or worse. The injury due to the regeneration depends largely upon the location of the process. When fibrous tissue forms on surfaces, it generally produces only puckered scars; but when it forms in ducts, in narrow passages, or on enclosed spaces, it frequently obstructs nature's vital processes. This principle may be illustrated by the effect of the streptococcus or other toxic agents on the kidneys; the destruction of glomeruli and tubules is followed by fibrous contraction, and later by insufficiency and edema. An infection located on the heart valves produces as a late sequel fibrous contraction (stenosis), which may go to the point of hindering the flow of blood. Other common effects of fibrous contraction are tabes dorsalis, liver cirrhosis, optic atrophy, pyloric obstruction, and urethral stricture.

There are many other disease conditions due to fibrous contraction, not the least of which are many sequelae of healed and healing tuberculosis. It seems logical to assume that, just as many tuberculous infections have been overlooked in the past, so also the sequelae of such infections have been overlooked or not even suspected. Many times the condition has been attributed to some other disease process, and the primary remote cause not considered. The purpose of this discourse is to bring into sharper focus a few of the important sequelae of tuberculosis.

For many reasons the discussion will be restricted to those conditions within the chest. Many others could be described in other parts of the body, but there is not time to do more than merely mention important ones, such as Addison's disease, ankylosis of the various joints with distortion and shortening, tuberculous cirrhosis of the liver, certain types of ulcerative colitis, the fibroid or "lead pipe" colon, and the "autonephrectomy."

From the Research Laboratories of the City of Chicago Municipal Tuberculosis Sanitarium.

The exact incidence of the sequelae of pulmonary tuberculosis is not known. Each of the sequelae to be discussed has been found several times in a series of about 2300 autopsies. The last condition which I shall discuss (bullous emphysema with cardiac embarrassment) is represented by about 10 cases, or 0.5 per cent of all cases coming to autopsy. Probably the greater number of these cases are found in general hospitals, because all evidence of tuberculosis has disappeared before the final illness. Korol[1] estimated that 30 per cent of the veterans of World War I who are in Veterans Hospitals because of pulmonary disease have bullous emphysema of the upper lobe. Probably not all cases of bullous emphysema are due to chronic tuberculosis, because Sweany, Levinson, and Stadnichenko[2] found bullous emphysema in the lungs of 4 per cent of adult patients dying from causes other than tuberculosis. It is certain, however, that a high percentage of the cases of bullous emphysema follow an advanced healing tuberculosis, and that some of these patients develop a right-sided heart failure.

The most important groups of late sequelae that arise within the chest include those involving the pleura, the blood vessels, the lymphatics, the bronchi, and, most important of all, the lung parenchyma.

Sequelae Involving the Pleura

The effects of pleuritis are largely those of a distortion due to contraction. Sometimes the fibroid pleuritis is due to organization of effusions, which compresses the lung tissue and leads to mechanical atelectasis. When bilateral, this condition produces serious respiratory embarrassment. It may also cause a pull on the heart and vessels that disturbs the circulation. Practically always there is pressure on nerves within the pleura — sometimes on the intercostal nerves — which may lead to pain and discomfort. Often the sympathetic and vagus nerves are entrapped in fibrous tissue; this condition is painful and produces a deranged respiratory physiology.

Sequelae Involving the Blood Vessels

Disturbance of the pulmonary vessels may be of several types. Destruction of the bronchial arteries is frequent and produces a poorly nourished lung, which leads to a weakening of elastic tissue and resulting emphysema or bronchiectasis. The pulmonary arteries and veins may be closed by fibrosis or thrombosis, or they may be buckled in a way that shuts off or restricts the circulation.

Sequelae Involving the Lymph Nodes

The lymph nodes are important primarily because of the pressure they may exert on the bronchi, thus leading to an atelectasis of the lobules or lobes of the lung. Along with the mechanical pressure, the tuberculous foci produce a toxic effect that radiates into the perivascular spaces and bronchial wall, producing first inflammation and effusion, then subacute and chronic changes that result in fibrosis. The peribronchial and interstitial fibrosis contracts upon healing, causing bronchial stenosis.

An illustration of a "chain reaction" due primarily to enlarged bronchial lymph nodes will be appropriate.

Case 1

The patient was an American woman who was 19 years old at the time of death. There was nothing unusual in the history.

A roentgenogram taken on admission showed a dense shadow along the spine, about 2 cm. broad, extending from the apex to the hilum (lobitis). There were infiltrative areas characteristic of tuberculosis in the upper parts of both lungs. Pneumothorax was attempted without success. The sputum was positive for tuberculosis.

At the postmortem examination an atelectatic left upper lobe was found and recent solid masses were seen throughout the left lower and the right upper lobes. There were scattered acinous, nodose lesions in the lower parts of the right lung. Sagittal section showed a dry, spongy left upper lobe and tuberculous masses, cavities, and nodules elsewhere throughout the rest of the lungs. Forming a ring around the main upper lobe bronchus were three calcified tubercles 5 to 7 mm. in diameter. The lumen was narrowed to about half the normal size.

There was a mild degree of bronchiectasis in the principal bronchi of this lobe. Several calcified foci were scattered throughout the lobe, with the largest one, about 5 mm. in diameter, in the apex. The lung parenchyma was dry and spongy, with no caseation or consolidation, and with only a slight amount of fibrosis.

The microscopic sections revealed that all the calcifications had a uniform age character, consisting of a small central calcified core and an early specific capsule of moderate thickness. The oldest tubercles corresponded to a four- or five-year process. The parenchyma of the collapsed lobe showed a rather uniform atelectasis with occasional nodular tubercles, some of which had calcified centers. The bronchi at the level of the lymph nodes consisted of a ring of fibrosis extending in from the lymph node tubercles

1. Korol, E.: Pulmonary Emphysema in Tuberculosis, Am. Rev. Tuberc. 38:594-605 (Nov.) 1938.
2. Sweany, H. C., Levinson, S. A., and Stadnichenko, A. M. S.: Tuberculous Infection in People Dying of Causes Other than Tuberculosis, Am. Rev. Tuberc. 48:131-173 (Sept.) 1943.

towards the lumen. This case has been reported previously[3].

Calcified lymph node tubercles (pneumoliths) may rupture into a bronchus, causing hemorrhage, obstruction, and sometimes atelectasis. In one instance an occlusion, atelectasis, and abscess resulted from the discharge of a "lung stone" into a main bronchus. Symptoms disappeared after removal of the foreign body by the bronchoscope.

Sequelae Involving the Bronchi

Permanent stenosis of bronchi resulting from tuberculous ulceration of the mucosa is responsible for many signs and symptoms. The principal signs are cough, dyspnea, wheezing, and intermittent fever and expectoration. Eloesser[4], Samson[5], and Barnwell, Littig and Culp[6], among others, have described the complication. The clinical result is the same as in the last case, but the origin of the process is different, as the next report will show.

Case 2

The patient was an American woman of Norwegian extraction. Two other sisters had died of tuberculosis. Her mother died of "pneumonia" when the patient was 3 years old. The patient had tuberculous cervical lymph nodes, which drained when she was 12 years of age. Her illness began in July, 1931, as a cold. She was treated for bronchitis, then for "unresolved pneumonia" (atelectasis); finally a diagnosis of pulmonary tuberculosis was made. Cough and dyspnea were present at intervals.

The pertinent physical findings were numerous. Perhaps the most characteristic were sonorous rales over the upper lobes on normal breathing, with coarse moist rales after cough. The roentgenographic examination revealed a consolidation of the right upper lobe, with enlargement of the hilum. The sputum was positive for tubercle bacilli. A diagnosis of tuberculosis, far advanced—B, with "asthmatic bronchitis" was made.

The patient became progressively worse and the rales became more "musical" in character. She died in January, 1933.

The important postmortem observation, in addition to far advanced tuberculosis and the old cervical and hilar calcified lymph nodes, were deep, healed craters in the right main bronchus and on the right side of the trachea, with fibrous bands which narrowed the lumen at many places along the bronchus.

It is probable that an ulcerative bronchitis caused the bronchial occlusion, although the possibility that enlarged lymph nodes played a subsidiary role cannot be overlooked.

Another serious sequellar disease affecting the bronchi is bronchiectasis. There are two main theories concerning the origin of bronchiectasis—"pulsion" and "traction," both of which are anatomically demonstrable. Bronchiectasis involves practically every bronchus leading from a tuberculous focus, but only in chronic or healed disease does it cause symptoms.

Miller and Wallgren[7], Simon[8], Blumenberg[9], Bernard[10], and Jones, Peck, and Willis[11] describe the bronchiectasis which follows the *"healed,"* primary infection. A primary lesion always produces emphysema and damage to the bronchi in the region around it, and sometimes leads to dilatation. Sometimes a later nonspecific infection supervenes.

A case report will illustrate a permanent nonspecific infection superimposed on an old tuberculous bronchiectasis.

Case 3

This Negro girl was 19 years old at the time of death. Her mother was reported to have had "asthma" for six years. The patient had "pneumonia" in childhood. She was apparently well until April, 1931, when she developed a cough. A school physician made the diagnosis of tuberculosis. The most important features of her case were the postmortem findings.

There were numerous bronchiectatic cavities in the whole right upper lobe. This process was in direct anatomic relation to primary calcified lymph nodes at the hilum and along the right side of the trachea. It was a bronchiectasis following a massive healed primary infection. The sputum was negative for tubercle bacilli while the patient was under observation, and no specific lesions could be found at autopsy.

The incidence of bronchiectasis following secondary tuberculosis is even greater than that which results from the healing of primary lesions. Simon[8] says that the part played by advanced tuberculosis in producing bronchiectasis is well known.

Sequelae Involving the Pulmonary Parenchyma

The pulmonary parenchyma may be involved in several different disease conditions. Atelectasis, or a collapse of the pulmonary alveoli, will be mentioned first. One of the first to recognize this condition clinically was Bernard[10], who described consolidations of

3. Sweany, H. C.: Age Morphology of Primary Tubercles, Springfield, Illinois, Charles C. Thomas, 1941.
4. Eloesser, L.: Bronchial Stenosis in Pulmonary Tuberculosis, with Some Notes on Tuberculous Stenosis of the Trachea and Bronchioles, Am. Rev. Tuberc. 30:123-180 (Aug.) 1934.
5. Samson, P. C.: Diagnosis, Treatment and Prognosis in Tuberculous Tracheobronchitis, J. Thoracic Surg. 6:561-582 (June) 1937.
6. Barnwell, J. B., Littig, J., and Culp, J. E.: Ulcerative Tuberculous Tracheobronchitis, Am. Rev. Tuberc. 36:8-45 (July) 1937.
7. Miller, J. A., and Wallgren, A.: Pulmonary Tuberculosis in Adults and Children, New York, Thomas Nelson & Sons, 1939.
8. Simon, G.: Ueber typische fruehe tuberkulœse Lungenspitzen herde bei Kindern, Ztschr. f. Tuberk. 42:333-363, 1925.
9. Blumenberg, W.: Die Tuberkulose des Menschen in den verschiedenen Lebensaltern, Beitr. z. Klin. d. Tuberk. 62: 532, 1925; 63:13-59, 1926.
10. Bernard, L.: Les Debuts et Les Arrets de la Tuberculose Pulmonaire, Paris, Masson et Cie, 1931.
11. Jones, E. M., Peck, W. M., and Willis, H. S.: Bronchiectasis Following Primary Tuberculosis, Am. J. Dis. Child. 72:296-309 (Sept.) 1946.

the upper lobe as "lobite," or lobitis. It may be due to blocking of bronchi by lymph nodes or fibrous tissue, as in case 1. It may be due to external pressure, to fibrous tissue, or to operative procedures which force air out mechanically. It may be purely regional, resulting from a primary or re-infection tuberculosis.

Undoubtedly the most important sequel of pulmonary tuberculosis is the emphysema of healing which many times advances to a "cystic" lung. This type of cystic lung is not to be confused with the congenital variety; actually it amounts to an extreme degree of bullous emphysema. This condition results from destruction of the elastic fibers of the lung by toxic, nutritional, and mechanical causes. The interference with nutrition follows an endarteritis or destruction of the pulmonary arterioles[12] and bronchial arteries[13]. The result is a debilitating anemia which may be demonstrated by angiopneumography. According to Korol[1], collateral circulation by way of adhesions helps to reverse a developing emphysema.

In tuberculosis practically all of the above mentioned causes of emphysema may be present. The toxic effect of the tubercle bacillus is aided by injury, destruction, or stretching of the arterioles and arteries, and finally, as the disease advances, by a direct distention of alveoli due to the compensatory effort or to the positive pressure of the air trapped in distended alveoli.

The mechanism of the process is difficult to follow except by painstaking histopathologic techniques. In our studies we have used the third-dimension method so well employed by Miller[14] in his work on lung anatomy. By this method we have found that the same contraction that takes place in the larger bronchi[15] also takes place in the smaller ones. Small valvular mechanisms develop. After a time a great many bronchioles are cut off entirely, leaving blind sacs of trapped air. When the openings are completely stopped, local atelectasis results. Usually the process gradually stretches the alveoli until there appear openings between the alveoli which are said to begin in the much disputed Kohn pores. The distention continues until the respiratory and larger bronchioles are involved. The walls of all structures disappear, and thin threads remain like the ropes supporting a tent. These finally break one by one, until nothing is left in a whole segment of a lobe but a large bulla with threads in the cavity. If this condition involves a whole lobe or lung, it becomes a "cystic" lung. The pathogenesis of advanced emphysema and of this type of cystic lung is essentially the same.

A case of a patient with an old healed lesion will illustrate an uncomplicated emphysematous process.

Case 4

This patient, a white male who was 61 years old at death, had no family history of tuberculosis. He had pneumonia at 16 years of age, and influenza at the age of 43. The onset of his disease was insidious, seven years before death. At the time of his entry there was a huge cavity in the left upper lobe that increased very little in size during the seven years. His sputum was positive for tuberculosis.

At autopsy there was found a large, ossified primary lesion in the left base, surrounded by a large area of emphysema filling almost all the lobe. A large, multiple calcified complex was seen at the hilum. This process probably was many decades old.

Another case will be cited to illustrate the occurrence of acute infection and edema in a healed, secondary tuberculous lesion.

Case 5

An American woman of Swedish extraction was exposed to a sister who had tuberculosis. Her illness began with an attack of influenza. She continued to work, but finally lost weight, became fatigued, and was told that she had "weak lungs."

There was a bilateral nodular apical tuberculosis that gradually underwent calcification. She came into the Sanitarium, and after seven years her disease was pronounced apparently arrested. The lesions finally became densely calcified. A duodenal ulcer developed during her stay in the hospital. After leaving the hospital, she had a bout of vomiting, and the right upper lobe of the lung became so filled with moisture that a gastroenterologist made a diagnosis of tuberculosis. After three weeks of rest and treatment of the ulcer the rales disappeared and the patient returned to normal health. Apparently the rales were due to edema which developed in the emphysematous lung as a result of protracted vomiting. As soon as the equilibrium was restored, the edema disappeared.

The patient has had no return of pulmonary symptoms.

Occasionally an abscess is superimposed upon damaged lung tissue. Among the organisms responsible for such abscesses which have been found in our institution are streptococci, Friedländer's bacillus, fusospirochetes, Welch's bacillus, Bacillus pyocyaneus, and the colon bacillus.

12. Isaakssohn: Pathologisch-anatomische Veränderungen der Lungengefässe bei Emphysem, Virchows Arch. f. path. Anat. 53:466-469, 1871.
13. Loeschcke, H.: Das Lungenemphysem, in Henke, F. and Lubarsch, O.: Handbuch der spez. path. Anat. und Histologie, Berlin, J. Springer, 1928, Vol. 3, part I, pp. 612-689.
14. Miller, W. S.: The Lung, Springfield, Illinois, Charles C. Thomas, 1937.
15. (a) Spivek, M. L.: Obstructive Pulmonary Emphysema Due to Partial Obstruction of the Bronchi by Tuberculous Lesions, Am. J. Dis. Child. 51:69-83 (Jan.) 1936; (b) Faust, O. A.: Primary Tuberculosis, Obstructive Pulmonary Emphysema and Asthma with Recovery, Am. J. Dis. Child. 51:118-122 (Jan.) 1936.

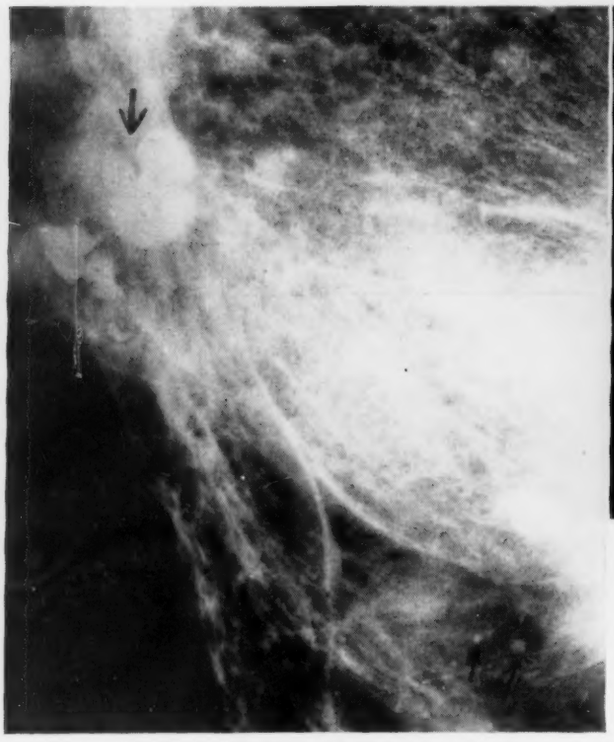

Fig. 1 (Case 4). A postmortem roentgenogram of the left lower part of the hilar region, with much of the lower lobe showing. Note the large calcified lesions in the middle of the lobe and the stringy fibrosis throughout.

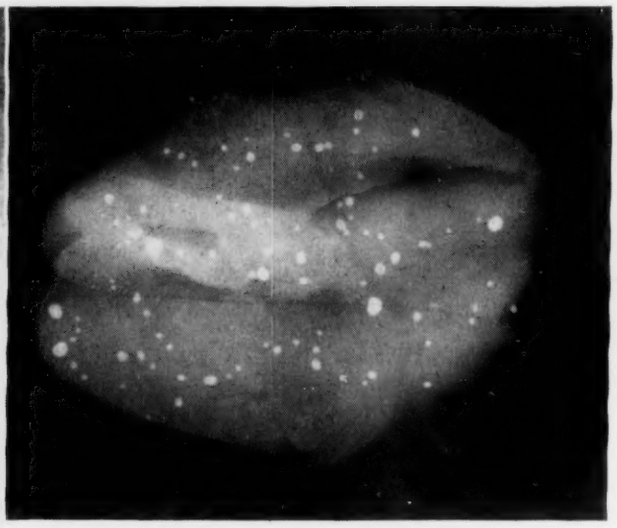

Fig. 2 (Case 4). A postmortem roentgenogram of the spleen, showing old multiple calcifications resulting from the hematogenous dissemination of the primary lesion.

Case 6

The patient was an American girl of Italian extraction, who was 24 years old at death. There was no known tuberculosis in the family and her own history was negative until 1929, when she had a hemorrhage. She went to the dispensary, but no diagnosis was made. She received pneumothorax in the Fresh Air Hospital, Chicago. She was admitted to the Sanitarium as a moderately advanced-B case on the basis of x-ray appearances. No tubercle bacilli were ever found in her sputum, but Bacillus pyocyaneus was always present.

She was given sanocrysin treatment, which produced a severe reaction. After this she failed rapidly and died.

The postmortem findings in the lungs were as follows: Multiple calcified primary lesions were present in the right upper and middle lobes, and there was a large calcified complex at the hilum. Evidence of collapse of the right lung, especially the upper lobe, was seen; the parietal pleura was thick and consisted of dense hyaline fibrous tissue. There was an abscess condition, apparently nontuberculous, in the middle and the right upper lobes; this seemed to be a terminal abscess on an old primary tuberculosis.

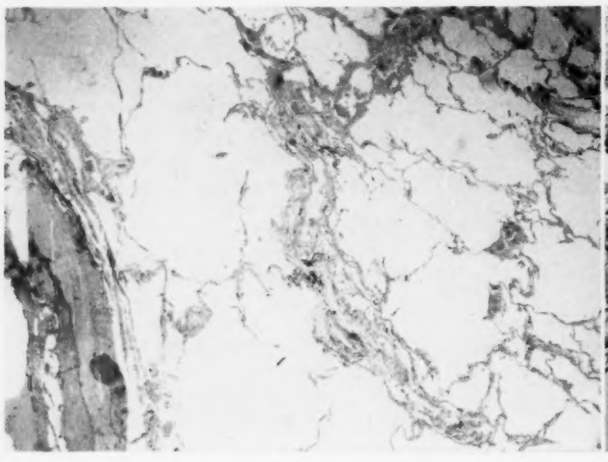

Fig. 3 (Case 4). A microscopic photograph showing a part of the old calcified parenchymal lesion seen in figure 1. Note the bone and marrow on the inner margin, and the marked emphysema alternating with fibrosis.

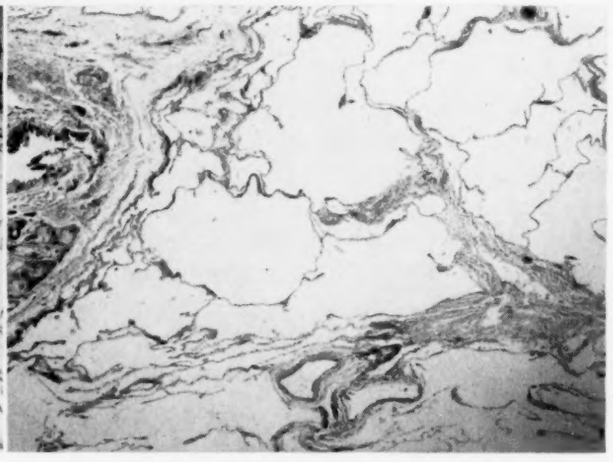

Fig. 4. A similar section several centimeters out from the calcification showing essentially the same pathology.

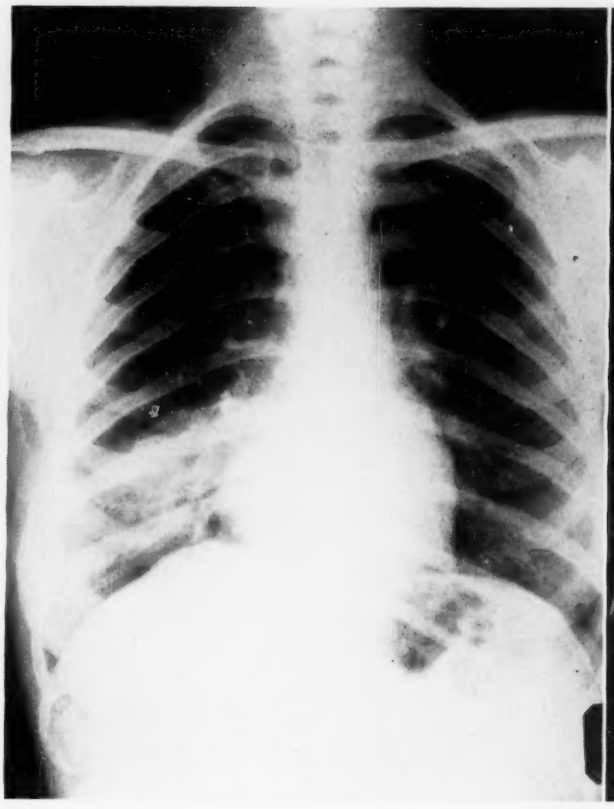

Fig. 5 (Case 6). An antemortem roentgenogram showing atelectasis in the right lower lobe.

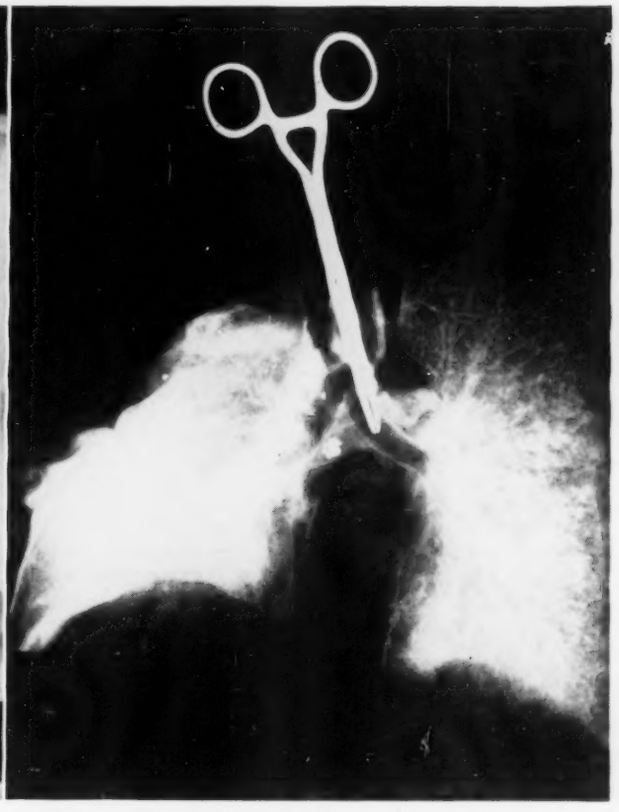

Fig. 6. A postmortem roentgenogram of the same case.

The sanocrysin apparently initiated the fatal symptoms.

While emphysema is present in practically any healed tuberculous lesion, only the extensive lesions produce severe symptoms. Most fibroid types result in advanced emphysema, but only a few go far enough to cause cardiac damage. It is probable, however, that in many patients who end up in general hospitals with heart disease due to the emphysema of healed tuberculosis, the remote cause of their heart condition is never recognized. The percentage of such cases would be hard to estimate.

As the functioning alveoli are gradually destroyed in the emphysema process, the pulmonary circuit is finally narrowed to such an extent that a gradually increasing pulmonary pressure is necessary to force the blood through the lungs. Thus a burden is thrown on the heart. The right side of the heart in particular is affected, and soon begins to enlarge. Visscher[16] has shown that this is a serious and rapidly progressive condition. As his experiments show, ". . . when the pulmonary pressure rises, thus restricting the thebesian flow, the oxygen content of the thebesian venous blood becomes consistently less than that of the coronary sinus blood." The right side of the heart is thus relatively anoxic, and a dangerous and rapidly fatal cycle is set up. Clinically, the patient is dyspneic, sometimes cyanotic. The x-ray re-

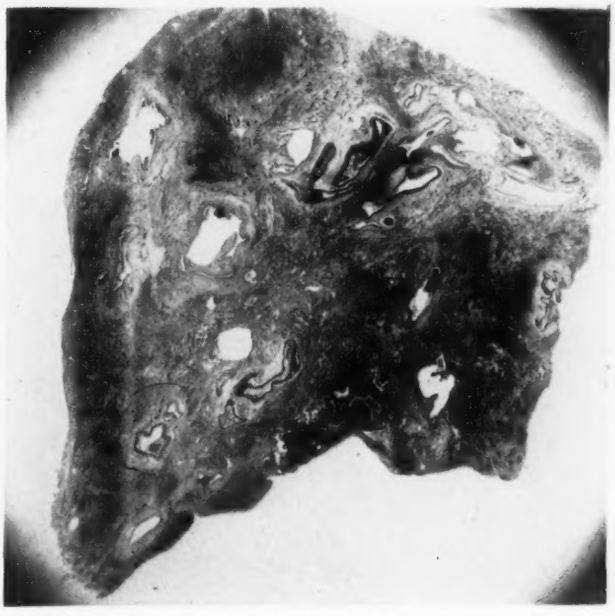

Fig. 7 (Case 6). A photograph of a cross section of the lower lobe of the lung, showing atelectasis and fibrosis.

16. Visscher, M. B.: The Restriction of the Coronary Flow as a General Factor in Heart Failure, J.A.M.A. 113:987-990 (Sept. 9) 1939.

veals an enlarged heart and fibrous apices of the lungs, with emphysema; lipiodol reveals extensive bronchiectasis. The electrocardiogram shows a tremendous right heart preponderance, with a gradually increasing arrhythmia as the disease progresses. The process is almost identical with that in advanced silicosis[17].

Three typical cases will be presented.

Case 7

F.H.C. was an Englishman, 59 years old when he died in 1938. He had been a railway clerk for 38 years. A fistula of twenty years' duration was removed in 1926. His pulmonary symptoms began in 1929. His usual weight was 124 pounds. During the last year of life he was dyspneic on moderate exertion.

The physical findings were principally those of a fibroid tuberculosis and a damaged heart. The patient's general development and general condition were fair; his skin was clear; the fingers were clubbed. The heart boundaries were within normal limits, but there were loud systolic and presystolic murmurs at the apex, and a presystolic thrill. The blood pressure was 140 systolic, 76 diastolic. Examination of the chest showed impaired expansion bilaterally and dullness over the upper third bilaterally. On the right there were varied rales and harsh breath sounds, with increased whispered voice in the upper half. The left side showed similar findings. The diagnosis was far-advanced pulmonary tuberculosis with multiple cavities bilaterally.

17. (a) Sweany, H. C., Porsche, J. D., and Douglass, J. R.: Chemical and Pathologic Study of Pneumonoconiosis, with Special Emphasis on Silicosis and Silicotuberculosis, Arch. Path. 22:593-633 (Nov.) 1936; (b) Kinney, W. M.: The Pathology of Silicosis and Silicotuberculosis, J. Missouri M.A. 33:257-260 (July) 1936.

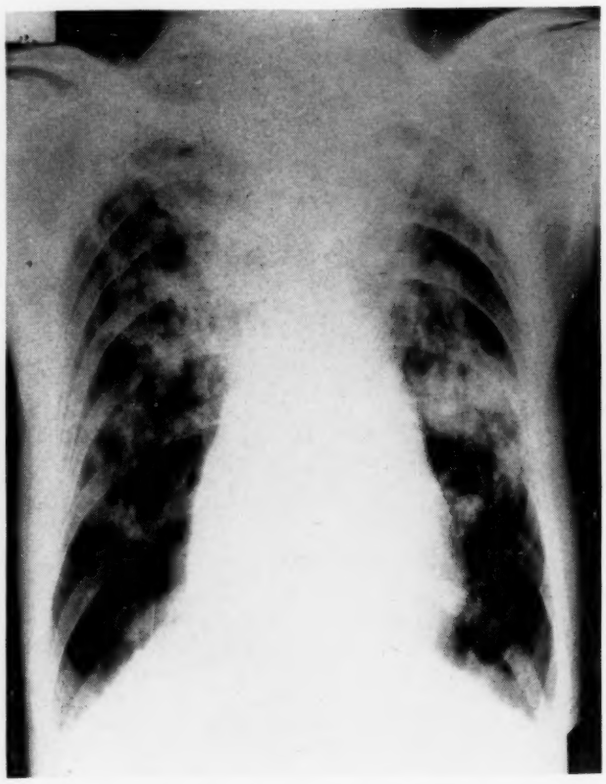

Fig. 8 (Case 7). An antemortem roentgenogram, showing fibroid apices, marked emphysema at both bases, and a tremendous enlargement of the heart.

Fig. 9 (Case 7). A postmortem roentgenogram of the lung, showing fibrocaseous apices with bullae at both bases.

Fig. 10. An inflated and dried specimen showing the gross appearance of the lung. No microscopic sections were taken of this specimen.

The electrocardiogram showed the rate to be 110, the rhythm irregular on account of extrasystoles; QRS_1, $_2$, and $_3$ were slurred; QRS_1 was low; $S\text{-}T_2$ and $_3$ were depressed. The diagnosis was myocardial damage and auricular premature contractions.

Stereoroentgenographic examination of the chest showed that the apices were both very hazy, the diaphragms were oblique, and the costophrenic angles were both obliterated. The cardiac shadow was enormously enlarged both to the right and to the left. There was an infiltration of both upper fields, characteristic of tuberculosis, and a marked emphysema at the bases.

No tubercle bacilli were ever found while this patient was under observation here.

The postmortem examination revealed scattered calcifications in both upper lobes up to 6 mm. in diameter. The bronchopulmonary nodes showed calcifications up to 4 mm. in diameter. There was a fibroid, 3-cm. cavity in the left upper lobe, with scattered acinous nodose and patchy pneumonic foci throughout both lungs. Extremely large bullae, up to 10 cm. in size, were seen along the diaphragmatic and anterior margins. There were no specific lesions of tuberculosis.

The heart weighed 415 Gm. All the chambers were dilated. The left ventricular wall measured 13 mm., and **the right ventricular wall measured 9 mm. in thickness.**

Other pathologic changes were not pertinent to this discussion.

Case 8

W.F. was a Bohemian, 65 years of age at the time of death. He came to the United States at the age of 17. There was no history of tuberculosis in the family, but his father died of pneumonia. The patient's disease manifested itself at the age of 43, with hemorrhage. He had had much dyspnea ever since.

The physical examination revealed a flaring outward of the lower costal borders; retraction of the clavicular spaces; impairment of resonance over the upper lobes, with an increase in resonance over the lowers; a few rales at the bases; and an increase in whispered voice sounds over both upper lobes.

The sputum was negative for tubercle bacilli.

The x-ray revealed fibrosis of the apices and enlargement of the heart.

Fig. 11 (Case 8). A postmortem roentgenogram showing much the same pathology as in case 7. Note the many calcifications in both upper lobes.

Fig. 12 (Case 8). A sagittal section showing bronchiectasis in both upper lobes and emphysema in both bases.

Fig. 13 (Case 8). A photograph of the lung margin. Note the "dishrag" appearance.

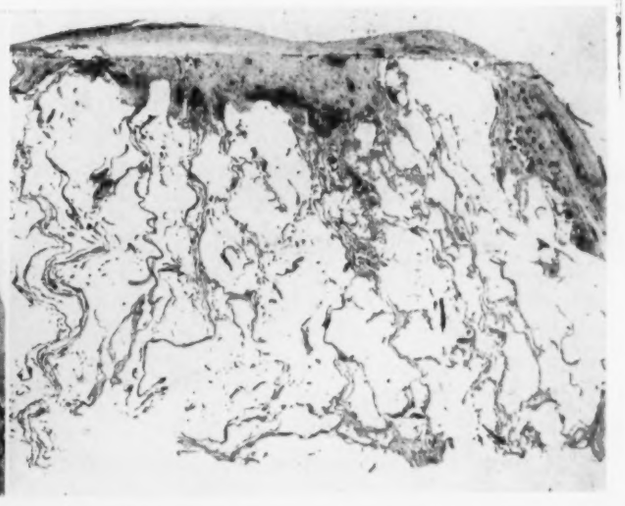

Fig. 14 (Case 8). A microscopic section of the lung, showing the marked emphysema.

At postmortem examination the heart was found to weigh 435 Gm.; the wall of the right ventricle measured 6 mm. in thickness; that of the left 17 mm. In the lungs were old contracted cavities, with bronchiectasis in both upper lobes, and an extreme degree of emphysema in both bases. Some huge bullae were present. Old primary lesions were seen, the largest in the right base. Microscopically, there was no evidence of tuberculosis; in fact, no specific lesions could be found at all. There was an extreme degree of emphysema.

Case 9

R.R. was an American, 47 years old at death. There was no history of tuberculosis in the family.

The patient stated that he had had bronchitis most of his life, with wheezing in his chest. His fatal illness began in 1936, as a cough, one year before death. Since 1908 he had been under observation for lung trouble, but no tubercle bacilli had ever been found.

The clinical examination revealed a lag at the right base with almost complete absence of breath sounds, but no impairment of resonance. There were sonorous rales at the right apex and scattered fine rales in the left base. The heart was much enlarged and showed signs of decompensation.

The electrocardiogram showed evidence of damage to the right side of the heart, and right ventricular preponderance. The diagnosis was myocardial damage and chronic cor pulmonale due to asthma, emphysema, or fibroid tuberculosis.

The postmortem examination showed that the right lower lobe was converted into a dishrag-like tissue with bullous emphysema at the margins. An old calcification 5 mm. in diameter was seen in the center of this lobe. The remaining lung was of rubbery consistency, and subcrepitant. The lymph nodes were anthracotic and not enlarged. The left lung was emphysematous throughout, with small bullae on the margins.

The heart weighed 425 Gm. The left ventricle was 17 mm. and **the right 9 mm. in thickness.**

This case represented an old extinct primary tuberculosis, followed by a reinfection process with complete healing, then slow development of a progressive emphysema and ultimate cardiac failure. The main point is that the tuberculous infection occurred in early life and that the sequelae developed only by a slow "attrition" of the lung tissue.

Summary

In summarizing the various conditions presented, it may be pointed out that any infection causes damage to tissue and that any healing of this damage forms scar tissue. On external surfaces this scar tissue does little harm. In the pleura it may lead to compression atelectasis. In narrow passages it causes strictures and stenoses that interfere with the normal physiology. As a result of some of these changes, vicious cycles are set up that bring mechanical factors to bear upon the normal physiology, producing a pathologic physiology.

Inasmuch as tuberculosis is still one of the most common lung diseases, it forms the groundwork for the development of a significant percentage of such diseases as atelectasis, bronchiectasis, and emphysema, as well as terminal cardiac failure.

Tuberculosis of the bronchi causes ulcers which form scar tissue as they heal. This scar tissue contracts for months after forming, so that the lumen is narrowed and atelectasis and symptoms of dyspnea result. Bronchiectasis may develop later if the stricture is not removed. Narrowing of bronchi by enlarged lymph nodes may produce the same result.

Following most primary infections and practically all healing reinfections, bronchiectasis, atelectasis, and emphysema result from destruction of the elastic tissue of the lungs and bronchi. These conditions are usually progressive and may not become troublesome until many years after the original disease has healed. During the wear and tear of life, the limited active alveolar reserve gradually becomes destroyed, and eventually a terminal dyspnea sets in. Finally, strain on the heart becomes so great that death frequently results from right-sided heart failure.

THE DEVELOPMENT OF THE TUBERCULOSIS CASE-FINDING PROGRAM IN NORTH CAROLINA

HERMAN F. EASOM, M.D., F.A.C.P.

WILSON

Early diagnosis of tuberculosis has long been recognized as one of the most important factors in any good tuberculosis control program. It has been stressed continually by the National Tuberculosis Association, state tuberculosis associations, sanatoria, health departments, and all other groups actively interested in the problem of tuberculosis control.

Establishment of the Extension Department of the North Carolina Sanatorium

North Carolina may justly be proud of its record in this field. The North Carolina Sanatorium had been established only a few years when Dr. L. B. McBrayer, superintendent, and Dr. Paul P. McCain, assistant superintendent, realized that some kind of public case-finding program was needed to increase the number of cases discovered early, and to prevent in every way possible the spread of the disease by patients with active cases. In 1914 they requested the State Legislature to appropriate $10,000 for the establishment

of an Extension Department of the North Carolina Sanatorium. This request was granted[1].

From 1914 to 1919 the Extension Department carried on an educational campaign by means of talks, conferences, and the distribution of literature on tuberculosis; sputum cups and all other supplies needed by a patient with an active case at home were sold at cost, and an outpatient diagnostic clinic was established in the sanatorium in 1915. During the first year only 232 patients were examined, but the next year 411 were seen[2]. This service proved very popular, and the volume of work in the clinic increased steadily, until in 1919 a total of 909 persons were examined[3].

County Clinics

The North Carolina Tuberculosis Association also became interested in case-finding, and in 1919 they employed a clinic physician who was to work out of the North Carolina Sanatorium in cooperation with the Extension Department. According to the report for that year, he conducted two county clinics and also helped in the outpatient clinic. The idea of county clinics caught on quickly, and more and more requests came in for the services of the clinic physician.

In January, 1924, Dr. L. B. McBrayer resigned as superintendent of the North Carolina Sanatorium, and Dr. Paul P. McCain, who had served as assistant superintendent for several years, was appointed to succeed him. Dr. McCain was deeply interested in all phases of tuberculosis work, and particularly in the work of the Extension Department. Soon after he became superintendent, arrangements were made for the Extension Department to take over the work of the diagnostic clinics which previously had been sponsored by the North Carolina Tuberculosis Association[4]. By that time the demand for clinics had become so great that it was necessary to employ a second full-time clinic physician. In 1925 these two doctors examined a total of 3,622 persons and found 862 new cases of tuberculosis[5].

1. Second Annual Report of the North Carolina Sanatorium, 1915, p. 19.
2. Third Annual Report of the North Carolina Sanatorium, 1916, p. 7.
3. Sixth Annual Report of the North Carolina Sanatorium, 1919, p. 20.
4. Eleventh Annual Report of the North Carolina Sanatorium, 1924, p. 11.
5. Twelfth Annual Report of the North Carolina Sanatorium, 1925, p. 14.

County clinics were held only upon request, and this usually came from the county health department and the county medical society. The coming of the clinic was publicized well in advance, and the schedule of appointments was made by the local health department. Physicians were first invited to submit the names of any persons they wished to have examined. Then appointments were given to former sanatorium patients, to contacts of active cases, to persons having suspicious symptoms, to food-handlers, and, finally, to anyone else desiring an examination. The clinic usually lasted one or two weeks, and in some counties was held regularly each year.

Sanatorium Sun

In March, 1926, the Extension Department began publication of *The Sanatorium Sun*[6], a monthly paper carrying articles on tuberculosis suitable for patients and the general public, news items concerning patients and staff, and a list of the most common symptoms of tuberculosis. Every patient receives the paper free while in the hospital and for one year afterward, after which the subscription price is only twenty-five cents a year. This paper has been a means of spreading sound information where it was most needed —namely, to patients and their relatives— and it has, no doubt, influenced many persons to seek examination who would otherwise not have done so. It has also helped to educate patients in regard to precautions against reactivation of their disease after leaving the sanatorium.

During the year 1926 a Negro health worker was employed jointly by the Extension Department and the North Carolina Tuberculosis Association[7]. It was hoped through her to reach thousands of Negroes with helpful facts about tuberculosis.

School Clinics

In 1926 an increase to $20,000 in the appropriation for the Extension Department made possible the beginning of school clinics, which proved to be one of the finest educational programs ever put on in this state. They were conducted upon request, usually from the local health department or county medical society. A clinic physician was sent

6. Thirteenth Annual Report of the North Carolina Sanatorium, 1926, p. 10.
7. Twelfth Annual Report of the North Carolina Sanatorium, 1925, p. 11.

to the county, and with the assistance of the public health nurse he gave skin tests to all grammar-school children who had their parents' permission. A 1:1000 dilution of Koch's old tuberculin was used routinely: 0.1 cc. was given intradermally, and the result was read at forty-eight hours. Teachers also were encouraged to take the test. Negative reactors were excused from further examination. Positive reactors were given a rather complete physical examination. After all skin tests and physical examinations had been completed in a county, the x-ray technician from the North Carolina Sanatorium came in and made anteroposterior and oblique films on all positive reactors. These were processed and interpreted at the North Carolina Sanatorium, and the reports were sent to the local health department.

The yield of active cases in school clinics was extremely low, but the educational value of the clinics was more than enough to make them worth while. A positive skin test on a child immediately attracted the parents' interest in a way that no amount of literature could have done. Then the parents were in a very receptive mood for more information on the subject of tuberculosis, and usually were quite willing to have the entire family examined in an effort to discover the source of the child's infection. These examinations often led to the discovery of unknown cases of active reinfection-type disease. As long as he was in the county, the clinic physician was available for talks before interested groups and for consultation on individual cases.

In some places the school clinics were directly responsible for the establishment of summer preventoria for undernourished positive reactors. These, in addition to being beneficial to the children, tended to focus the attention of the community on the importance of the tuberculosis program.

These school clinics proved very popular, and Dr. McCain found it necessary in 1929 to add a third clinic physician to take care of the ever-increasing demand for children's clinics, adult clinics, and examinations in the outpatient clinic. During that year 24,231 children were tested, of whom 12.07 per cent reacted positively and 1.62 per cent were found to show x-ray evidence of tuberculosis, usually of the healed primary type[8]. In 1929 2,439[9] persons were examined in the outpatient clinic at the North Carolina Sanatorium, and 1,881 in the county adult clinics held during the summer months[10]. School clinics were extended that year to include high-school students, because it was recognized that reinfection-type disease was more likely to develop after puberty.

From 1926 to 1946 the Extension Department gave skin tests to 498,563 white and 156,515 colored school children—a total of 655,078. In the colored group 21.4 per cent and in the white group 16.8 per cent were positive. Twelve thousand and one (12,001) cases of primary tuberculosis were found, and 1,110 of the reinfection type[11].

Portable Fluoroscopes

From the beginning of the county tuberculosis clinics in 1919 until 1935, the clinic physicians relied mainly on the history, physical findings, and the outcome of sputum examinations and tuberculin tests for diagnosis. In the earlier days x-ray facilities over the state were rather limited, and the quality of chest films often was unsatisfactory. Gradually the situation improved and it was possible to refer more doubtful cases for x-ray; the majority still were being given only a physical examination, however, and of course most minimal cases and some moderately advanced ones were missed. In 1935 specially designed portable fluoroscopes were purchased for the county clinics, and with these the clinic physician was able to see 25 to 100 patients daily instead of 12 or 15, and to find pulmonary tuberculosis in a much earlier stage than was possible by physical examination. During the two-year period 1940-1942, a total of 34,104 persons were examined in the fluoroscopic clinics and 725 new cases of tuberculosis were found[12].

X-Ray Interpretation Service

In addition to the adult and school clinics and the outpatient clinic, the Extension Department furnished from its beginning in 1914 a chest x-ray interpretation service. Dr. McCain invited any physician in the state to send chest films to the sanatorium for reading and recommendations. In 1930 only 229

8. Seventeenth Annual Report of the North Carolina Sanatorium, 1930, p. 10.
9. Seventeenth Annual Report of the North Carolina Sanatorium, 1930, p. 25.
10. Seventeenth Annual Report of the North Carolina Sanatorium, 1930, p. 15.
11. Unpublished data.
12. Biennial Report of the North Carolina Sanatorium and the Western North Carolina Sanatorium, 1940-42, p. 12.

films[13] were sent in, but during the two-year period 1942-1944 a total of 9,041[14] were received.

When World War II began, the Extension Department lost all of its physicians. An effort was made to continue the work, however, by sending an x-ray technician into the towns and counties upon request to make chest films of children and adults who had already been skin-tested by the local health officer. The films were processed and read at the Sanatorium. This type of service is still available. Dr. McCain himself continued the outpatient clinic at the North Carolina Sanatorium, and similar clinics were opened by the medical directors in both the Western and the Eastern Sanatoria. During the two-year period 1942-1944, a total of 8,987 persons were examined in these clinics.

North Carolina's Record

These various case-finding and educational programs started by Dr. L. B. McBrayer and Dr. P. P. McCain and continued with so much enthusiasm by Dr. McCain until his death have made North Carolina a leader in tuberculosis control in the South. Numerous physicians from other states have spent time in North Carolina observing the work here. Many doctors now in practice in the state have spent some time in one of the sanatoria learning facts about the disease which have enabled them to make an early diagnosis more often.

Mass Surveys

The development within the past few years of equipment for making miniature chest films has made possible a great expansion of the case-finding programs everywhere. The appropriation of $10,000,000 by Congress in 1944 for tuberculosis control in the United States provided the necessary funds. Soon afterward a Division of Tuberculosis Control was established in the North Carolina State Board of Health. The new division set about to equip itself with the new type of photoroentgen mobile units; delivery was slow, however, and to date they have been able to get only six units. The director of the division says that he has more requests for surveys than he can take care of for some time to come, and he feels that the enthusiastic reception granted his department by the public is the result largely of the excellent groundwork laid by Dr. McCain through the Extension Department.

The Bureau of Tuberculosis Control made x-rays of 210,000 persons in 1946, and of 116,000 more during the first six months of 1947. Between 3 and 4 cases of tuberculosis per 1,000 examinations were found. Of the cases found, 67.6 per cent were minimal, 15.3 per cent moderately advanced, 6.4 per cent far advanced, and 10.7 per cent in an unknown stage. It is especially encouraging to note the relatively large number of cases diagnosed in the minimal stage by this method as compared to the older methods; this improvement should result in shorter periods of hospitalization, fewer infected contacts, and more arrested cases suitable for rehabilitation.

Summary

The development of an official tuberculosis case-finding and educational program in North Carolina has been traced from its beginning in 1914 to its present expanded stage. To Dr. Paul P. McCain should go most credit for its growth and for its popularity with the medical profession and the general public.

13. Seventeenth Annual Report of the North Carolina Sanatorium, 1930, p. 14.
14. Reports of North Carolina Institutions for Physical Defectives, 1942-44, p. 13.

Maternal Welfare Section*

CASE REPORTS FROM THE MATERNAL WELFARE COMMITTEE

Tuberculosis Complicated by Pregnancy

Opinion as to the influence of pregnancy and labor on pulmonary tuberculosis varies widely. The obstetric literature each year contains several articles on this important subject. The incidence of tuberculosis among pregnant women is consistently given as 1 to 2 per cent in the various reports[1]. The in-

*Prepared for the Maternal Welfare Committee of the Medical Society of the State of North Carolina.

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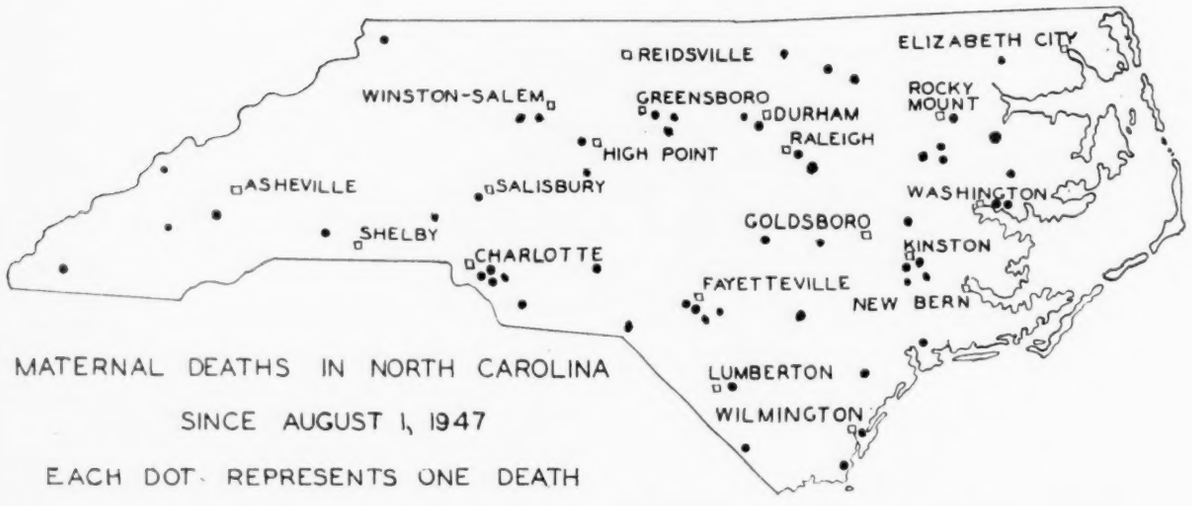
1. (a) Eisele, C. W., Tucker, W. B., Vines, R. W., and Batty, J. L.: Problem of Unsuspected Tuberculosis in Pregnancy: Incidence by Roentgenologic Techniques Compared with Incidence of Unsuspected Syphilis, Am. J. Obst. & Gynec. 44:183-196 (Aug.) 1942; (b) Frank, R. and Jacobs, A. L.: Chest Screening in Antenatal Clinic, Brit. M. J. 1:394 (March 18) 1944.



cidence is somewhat greater in colored than in white patients. Approximately 75 per cent of investigators agree that pregnancy has an adverse effect upon the course of tuberculosis[2]. All observers agree that unrecognized and untreated tuberculosis complicated by pregnancy represents a serious hazard to the mother's life.

Ignorance, poverty, and a lack of facilities are often factors in a patient's failure to seek treatment or to cooperate with her physician when the combination of pregnancy and tuberculosis is recognized. In some cases, however, failure of the physician to make the diagnosis of tuberculosis may be responsible for improper treatment and may lead to an untimely death.

Exacerbation of tuberculosis may occur in the early months of pregnancy, or within the first few months following delivery. The problem is illustrated by the following case reports.

Case 1—N. C. M. W. C. 227

A 17-year-old unmarried colored girl consulted a physician in the fourth month of her second pregnancy. Her history and physical examination revealed no significant findings in any of the major systems. She was followed during the prenatal period, and no abnormality was recorded. Her blood pressure was normal at all times, and no albumin or other abnormal urinary findings were recorded. She gained 18 pounds during the course of her pregnancy.

Labor began spontaneously on April 6, 1947, at term. She was delivered in a hospital after a six-hour labor. Delivery under a light ether anesthetic was normal and spontaneous.

The puerperium was uncomplicated during the first fourteen days. Then the patient began to have a moderate productive cough and to run fever. On the twentieth postpartum day, an x-ray of the chest revealed consolidation of the middle lobe of the right lung, and an x-ray diagnosis of pulmonary tuberculosis was made. In spite of the best care, the lesion progressed rapidly until there was extensive involvement of both lungs. The patient died on June 18—eleven weeks after her delivery.

2. Meixner, F. M. F.: Pregnancy in Tuberculosis, Dis. of Chest 11:409-418 (Sept.-Oct.) 1945.

Case 2—N. C. M. W. C. 226

A 30-year-old colored woman first consulted a physician in the seventh month of pregnancy. She had no complaint, and the history and physical examination revealed no abnormality. There was a known family history of tuberculosis. Her usual weight was given as 105 pounds. On her first visit to the physician, she weighed 121 pounds, and she gained 9 more pounds during the rest of her pregnancy. No complication occurred during the prenatal period.

On February 3, 1947, the spontaneous onset of labor was followed after eight hours by the spontaneous delivery of a normal child. A few whiffs of chloroform were used for anesthesia. The puerperium was apparently uncomplicated, and the patient was entirely well when she was seen on the tenth postpartum day. Four weeks after delivery she began to have fever each day, and complained of general malaise. Eight weeks **post partum**, on April 16, she was observed to be chronically and desperately ill; she had abdominal swelling which continued until the time of her death, and she lost weight rapidly.

Physical examination showed the patient to be pale, markedly emaciated, and mentally dull. The tongue showed moderate atrophy at the margins. Examination of the chest revealed limited descent of the diaphragm and decreased intensity of the breath sounds at the base of the right lung, but no rales or wheezes were present. The abdomen was protuberant, with full flanks; the entire abdomen was soft and doughy to palpation. The liver edge was felt one finger's breadth below the costal margin. No additional positive findings were recorded. Laboratory examinations of the blood and urine were within normal limits.

X-ray of the chest showed an area of increased density, not sharply defined, overlying the right fourth rib anteriorly; it had the appearance of a soft parenchymal lesion. A small area of increased density was seen in the periphery of the right second interspace anteriorly. The costophrenic angle was obscured by pleural thickening. There was a small amount of pleural fluid. The heart was not enlarged. The left lung field was clear. The findings in the right lung field were felt to be due to active pulmonary tuberculosis.

The patient's course was progressively down hill, and on July 6, five months after delivery, death resulted from pulmonary tuberculosis and tuberculous peritonitis.

Discussion

Each of these patients died of a fulminating type of tuberculosis. In each case, the diagnosis of tuberculosis was made when acute manifestations of the disease appeared in the puerperium. It is possible that infection began after the patients' delivery, but it is much more likely that an active lesion was present during their pregnancy. Early diagnosis, with proper care of the tuberculous lesion during the prenatal period and immediately following delivery, might have saved each patient's life.

Routine fluoroscopic and x-ray examination of prenatal patients is essential to a diagnosis of early pulmonary tuberculosis complicating pregnancy. It is generally agreed that it is impossible to diagnose an early pulmonary lesion by physical examination alone.

The course of tuberculosis is usually determined by the medical care the patient receives. Interruption of pregnancy offers little to the tuberculous patient if it is not followed by modern medical treatment of the tuberculosis.

Several specific points concerning the treatment of tuberculosis complicated by pregnancy are generally accepted:

1. An active spreading tuberculous pulmonary lesion complicated by early pregnancy is an indication for therapeutic abortion. After the fourth month, however, intervention is contraindicated because its effect is comparable to that of full-term delivery.

2. Healed tuberculosis is not an indication for abortion.

3. The prognosis for mother and child depends largely upon the degree of cooperation between obstetrician and phthisiologist. Sanatorium supervision, collapse therapy, and other specific measures must be continued during pregnancy and the puerperium.

4. Patients with chronic forms of tuberculosis under satisfactory treatment may be successfully carried through pregnancy without adverse effects on the tuberculous lesion[3].

3. (a) Cohen, R. C.: Effect of Pregnancy and Parturition on Pulmonary Tuberculosis, Brit. M. J. 2:775-776 (Dec. 18) 1943; (b) Cutler, J. W.: Harmful Influence of Pregnancy on Advanced Tuberculosis as Modified by Collapse Therapy, Am. J. Obst. & Gynec. 47:1-19 (Jan.) 1944; (c) Greenhill, J. P.: Year Book of Obstetrics and Gynecology, Chicago, The Year Book Publishers, 1946, p. 62.

The X-raying of chest in the large induction centers graphically demonstrated to the lay public and the medical profession that the chest X-ray is as much a part of the general physical examination as the Kahn, the complete blood count, or the urinalysis, and that tuberculosis can be diagnosed in the minimal stage only by X-raying the chest of the healthy individual.—W. J. Bryan, M.D., Contact, Ill. TB Assn., Apr., 1946.

THUMBNAIL SKETCHES OF EMINENT PHYSICIANS

OBSTETRICS AND GYNECOLOGY IN AMERICA

JOSIAH C. TRENT, M.D., F.A.C.S., *Editor*
DURHAM, NORTH CAROLINA

XI

HOWARD ATWOOD KELLY, 1858-1943

Less than a century ago, innumerable women in every walk of life were forced to endure painful, distressing, often humiliating disabilities, without hope of cure or relief. Doctors and surgeons feared to espouse gynecology, the dangerous mistress of their science, since the way she trod was obscure and edged with death. The suffering women were passed on from one physician to another and found no help; *ne les touchez* made pariahs of these suffering ones. Yet here and there a few doctors were drawn to the study of gynecologic problems and, more bold than their colleagues, devoted their lives to the science. To their courage and to their skill in evolving medical and surgical techniques many women of today owe health and even life itself.

Among these enterprising men were James Marion Sims and T. Addis Emmet, with whom earlier "Thumbnail Sketches" have dealt. During the years while those two brilliant surgeons were directing the Woman's Hospital of New York, there was born, on February 20, 1858, one destined to carry on their work: Howard Atwood Kelly.

Born in Camden, New Jersey, Dr. Kelly received his academic education at the University of Pennsylvania. Throughout the greater part of his college career he prepared himself for research in the natural sciences; then he determined to go into medi-

cine. He graduated with honors in 1877, and in the fall of that year he entered the medical department of the University. A persistent insomnia, brought on by an overactive mind, interrupted his course for a year, which he spent on the plains of Colorado.

Immediately after receiving his medical degree, in 1882, Kelly served his residency in the Episcopal Hospital and there became deeply interested in the poor of Kensington, a mill district on the outskirts of Philadelphia. He determined to practise in this district rather than uptown, whither the circumstances of birth and ample means strongly beckoned him.

In the Episcopal Hospital, the wards were filled with general surgical and medical patients; the specialties were still in their infancy, and gynecologic surgery was unwelcome. Perhaps for that very reason the young zealot, Kelly, became interested in the diseases of women. During his year of residency he prepared for the *Medical News* a report on a method of extracting kidneys through the vaginal vault, an article which attracted the attention of William Osler in Montreal.

Kelly's first move, when his medical training was completed, was to establish himself in a small house in Kensington, where, with the help of a woman whom he trained in nursing care, he treated patients for whom there was no place in the larger hospitals. From this small beginning eventually emerged the well-known Kensington Hospital for Women.

Several trips abroad to study and observe, and avid reading of gynecologic literature contributed to the young surgeon's equipment for the specialty he had chosen. Meanwhile, former professors kept an eye on his work—among them, Osler, who had come to the University of Pennsylvania as professor of clinical medicine. When Professor Goodell was about to retire, Kelly was sought to succeed him in the chair of gynecology; in the interim he was appointed, jointly with Barton Cooke Hirst, to the associate professorship of obstetrics.

During Kensington days, Kelly developed the combined vaginal and abdominal method of examination—a great aid to diagnosis—, perfected the common plastic repairs, and successfully operated through the abdomen. At this time he began the work on the female urinary tract which he subsequently considered his most important contribution to gynecology. At Kensington, too, a large obstetric practice led him to devise the pad still used universally not only in cases of childbirth but in all pelvic operations.

The Department of Gynecology at his *alma mater* was never to know Dr. Kelly's guiding hand. Developments in another city to the south opened up wider avenues of service, more attractive to the young surgeon. In Baltimore the Johns Hopkins University under President Gilman, seeking to carry out the terms of the will of its benefactor, was establishing a medical department. Welch occupied the chair of pathology, and Osler that of medicine. Halsted was then secured for surgery, and Kelly was offered the appointment of professor of obstetrics and gynecology, which he determined in the fall of 1889 to accept. So it came about that these four, each to become illustrious in his own field, shared the distinction of being the founders of the Johns Hopkins Medical School.

Never vitally interested in obstetrics, Kelly after some years took measures to have the professorship divided; he retained the chair of gynecology from 1899 until 1919, when he became professor emeritus. Many of his students have risen to eminence and today occupy chairs of gynecology in outstanding schools of medicine. Several hundreds came back, in 1933, on the seventy-fifth birthday of their "Chief," to honor the man who had given so much to them.

Side by side with the School of Medicine grew the Johns Hopkins Hospital, but not even here was there room enough to accommodate the patients who flocked from all parts of the world to avail themselves of Dr. Kelly's skill. An old hand at meeting emergencies, Dr. Kelly converted a house on Eutaw Place into a small hospital; by 1913 it had grown into four units and was incorporated as the Howard A. Kelly Hospital.

A brilliant mind that went at once to the crux of a matter and a great manual dexterity that executed his decisions in a flash —these combined with a boldness born of assurance to place Howard Kelly in the front rank of his profession. His efforts were crowned with success: extra-uterine pregnancies were recognized and dealt with in

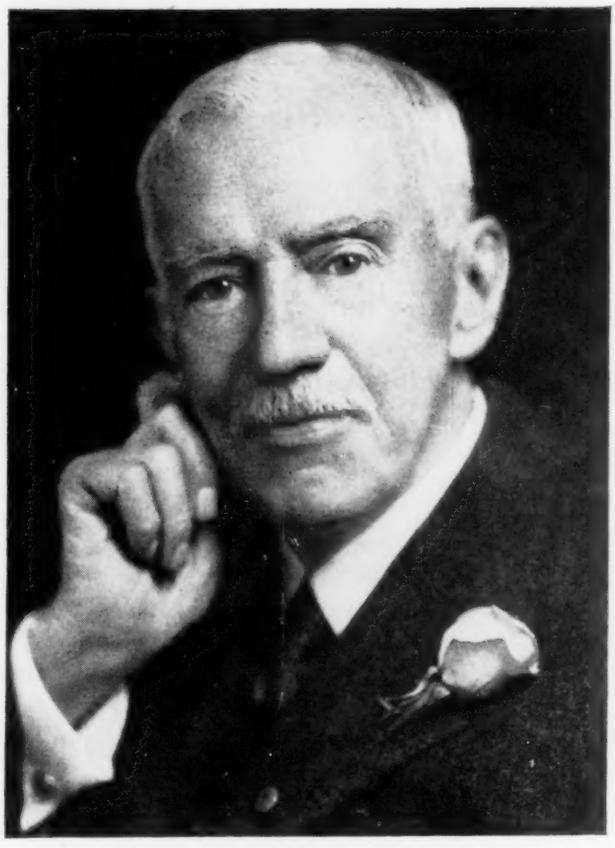


Fig. 1. Howard Atwood Kelly, 1858-1943.

the days when few could have made the diagnosis, much less have attempted the operation; his suspensions, amputations, and extirpations of the generative organs and his cesarean sections blazed new trails and made safe the way for others to follow. Madame Curie's discovery of radium opened up a new method for treating cancer, and a supply of radium, bought in 1904 and augmented from time to time, was in Kelly's hands a boon to those suffering from malignancies. Facilities for deep x-ray therapy were added and employed. Under Kelly, electrosurgery too was developed.

However, his was not only to know and to act, but also to pass on his knowledge; therefore cases and methods giving promises of helpfulness were promptly and carefully recorded in the literature. Some six hundred articles and many textbooks came from Kelly's pen. As a young man he had been disappointed in the illustrations accompanying medical texts, and he began to use his own line-drawings to picture the lesions treated and the methods employed. Early in the century he was impressed by the work of the artist, Max Broedel; these two men worked together to improve medical illustration, and the development of the modern school of art as applied to medicine is ascribed to their joint efforts.

Dr. Kelly was interested not only in current medical literature but also in the work of the pathfinders. Medical history filled his shelves, and his study in this field led to his compilation of a useful work on American medical biography. By active participation in the medical historical groups, he quickened and fostered in his students an interest in the work of their scientific forebears.

Through the many years devoted to medicine and surgery, however, Dr. Kelly never lost his zeal for the natural sciences. Mycology, herpetology, geology, botany, and astronomy afforded diversion, and their pursuit sent him every winter to Florida and every summer to his camp in Canada, where he indoctrinated his nine children in the mysteries of nature. An expert swimmer and canoeist, he spent hours on his beloved Lake Ahmic, renewing his health and strength for the winter's exacting work.

Above all, Dr. Kelly was an earnest Christian whose strong faith reached back into early childhood. To him, the poor who sought his aid were his "honor cases." To the poor who gave him their trust in the beginning of his practice he attributed his success, and to them throughout his long life he gave freely of his skill and talent. His door and his heart were open at all times to those burdened or in need. A man of genius and a man of God, Dr. Kelly in a humble, unpretentious way lived a life of service to his fellow man. His body grew frail with the passing years, but his mind was quick and his spirit was valiant to the end. Kelly of Baltimore died on January 12, 1943, just a few weeks before his eighty-fifth birthday.

AUDREY W. DAVIS
Baltimore, Maryland

So much emphasis has been placed on tuberculosis as a serious disease of girls and young women that its greater havoc among men has not received the attention that it deserves. As a result of the more rapid decline of tuberculosis in females in this country there are today 156 deaths among males to every 100 deaths in females and only at ages ten to thirty is the mortality higher in females. Tuberculosis is increasingly becoming a disease of older, occupied men.—Henry D. Chadwick, M.D. and Alton S. Pope, M.D., The Modern Attack on Tuberculosis, The Commonwealth Fund, Revised, 1946.

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NOVEMBER, 1947

THE McCAIN MEMORIAL ISSUE

While the practice of preparing special numbers of a medical journal to honor individual physicians can easily be overdone, it is quite certain that the editorial board of the NORTH CAROLINA MEDICAL JOURNAL will not be criticized for authorizing the dedication of this month's issue to the memory of Paul Pressly McCain—past president of the Medical Society of the State of North Carolina and first chairman of the JOURNAL's editorial board. In his death last November the Society lost one of its most valuable members, the doctors of the state one of their best beloved colleagues, the patients of the State Tuberculosis Sanatoria one of their best friends, and the cause of tuberculosis control in North Carolina its greatest champion. Dr. McCain's contributions to medicine, as well as the many honors which he received in recognition of his splendid achievements, were outlined in an editorial tribute to him last December. As this editorial stated, however, "This outline does not tell of the man himself. Many times it has been said that if a vote were taken to select the best loved doctor in North Carolina, Paul McCain would be overwhelmingly chosen. Another measure of his worth is the fact that, during the thirty-two years he held public office, no one ever questioned his integrity, his ability, or his judgment."

To Dr. Paul Ringer of Asheville, present chairman of the editorial board, thanks are due for compiling the material for the McCain memorial issue. This fine collection of papers, each contributed as a labor of love by a friend of Paul McCain's, bears testimony to the high regard in which he was held by his colleagues in the field of tuberculosis control.

* * * *

THE TRUTH ABOUT STERILIZATION

North Carolina was one of the first states in the union to make legal the sterilization of persons who are mentally defective or who have certain forms of mental disease apt to be transmitted to their offspring. The legislature of 1919 passed the first sterilization law, but its wording was not clear, and no operations were performed until after the present act was passed in 1933[1]. By the end of 1945 only 1722 individuals had been sterilized, although it has been estimated that there are at least 71,000 feeble-minded persons in the state[1]. Compared with the other twenty-three states with similar laws, North Carolina is fifteenth in the ratio of sterilizations to population.

In an effort to create more interest in the matter, and to arouse more public sentiment for sterilizing the mentally unfit, the Human Betterment League of North Carolina is distributing a pamphlet on sterilization, in question and answer form. This is reproduced on page 749. The physicians of North Carolina would do well to study the questions and answers given, so that they may have accurate information on the subject. More than any other group of comparable size, they are in a position to influence public opinion and to help our state derive the benefit that it should from its excellent sterilization laws.

1. Richardson, W. P. and Gamble, Clarence J.: The Sterilization of the Insane and Mentally Deficient in North Carolina, North Carolina M. J. 8:19-21 (Jan.) 1947.

MRS. PAUL McCAIN—TUBERCULOSIS SEAL SALE CHAIRMAN

The *News Letter* of the North Carolina Tuberculosis Association for October announces that Mrs. Paul McCain is the State Seal Sale Chairman for 1947. A more fortunate choice could not be imagined. As the *News Letter* says, her interest in the control of tuberculosis

"is definitely no new ardor, but one that always has been an important part of her life. Her late husband, Dr. Paul P. McCain, was superintendent of North Carolina Sanatoria for 22 years, and he was well known throughout the State and nation as an outstanding man and a dynamic leader in the fight to control tuberculosis. Mrs. McCain's father, Dr. L. B. McBrayer, was superintendent of the North Carolina Sanatorium and later executive secretary of the North Carolina Tuberculosis Association."

The *News Letter* might have added that both Dr. McCain and Dr. McBrayer served as presidents of the State Medical Society, and that Dr. McBrayer was its secretary for fifteen years (1922-1937) — longer by far than any other man ever held that important office.

Mrs. McCain—known and loved by her many friends as "Sadie"—is the mother of the Auxiliary to the Medical Society of the State of North Carolina, and in 1944 was named North Carolina's Mother of the Year. This JOURNAL fully agrees with the *News Letter's* statement:

"Mrs. McCain is outstanding in the State, and it is a distinct honor and privilege to have her as State Seal Sale Chairman for 1947."

Mrs. McCain's message concerning the Tuberculosis Christmas Seal is so good that it is quoted in part:

"We are coming again to that time of year when our thoughts turn to the Tuberculosis Christmas Seal. This year we have not only a pretty seal but a very suggestive one—a team of oxen pulling a sled of Christmas trees. What a wonderful thought —TEAMWORK.

"Teamwork has saved 4,000,000 lives in the United States since the organization of the National Tuberculosis Association in 1904. It has saved 4,605 lives each year in North Carolina. Conservative figures say each death costs the State $3,000—thus, a saving of $4,000,000 per year. This same cooperation has brought about an 80% reduction in the death rate in the last 40 years. Teamwork in selling Christmas Seals and in Tuberculosis Education has had a great part in this fight. The splendid cooperation between tuberculosis leaders and governmental authorities in the providing of diagnostic facilities and beds for those needing treatment has been very important. We are proud of the showing of North Carolina in 1946—28.5 deaths per 100,000 against a national average of 35.9 deaths per 100,000. Another important factor in this overall teamwork picture is the part played in the fight by those who have had the disease themselves."

* * * *

"GENTLEMAN JIM" RETIRES

After forty-nine years of teaching, Dr. James Bell Bullitt has become professor emeritus. As instructor in anatomy at his alma mater, the University of Virginia, as professor of anatomy at the University of Mississippi, and for the past thirty-four years as professor of pathology at the University of North Carolina, Dr. Bullitt has contributed much to the training of many doctors in this and other states.

His students and confreres in medicine early came to have a profound respect for the breadth and depth of his general knowledge and for his ability as a pathologist. More than anything, however, they have valued the integrity of the man, and his innate qualities of generosity, unselfishness, modesty, kindness, considerateness, and courteousness. Instinctively these qualities have been recognized and appreciated by all who came in contact with him—hence the fond title of "Gentleman Jim" bestowed upon him by successive generations of medical students.

As teacher, medical officer in World War I, colonel in the Medical Reserve, active member and officer of county and state medical societies, friend and benefactor to the University and to many of his students, Dr. Bullitt has touched many lives and has had great influence in the fields of medicine and education. He is in truth a witness to his own immortality. His many students and friends hope that he will have many years in which to enjoy his golf, reading, woodcarving, and his studies in archaeology and anthropology—years in which many may benefit not only from his experience and knowledge as a pathologist, but also from his wise counsel as one of the elder medical statesmen in North Carolina.

A LESSON FROM THE FRITZ CASE

Recently there has been much said in the press about the case of Mr. R. L. Fritz, Jr., former president of the North Carolina Education Association, who was deprived of his teacher's certificate for careless handling of school funds. In the course of the investigation, some facts were brought out that are not too flattering to our secondary school system nor to our teachers. For example, Lynn Nisbet, a newspaper correspondent in Raleigh, wrote:

"It is of common belief—if not of common knowledge—that many local school officials juggle daily attendance records in order to secure or retain allotted teachers that might be lost on a basis of accurate attendance."

A former school teacher said:

"I was honest for the first month that I taught. My attendance averaged 76 per cent for the month and I put it down that way. But it jumped to 98 per cent the next month—and stayed there despite epidemics, bus breakdowns, bad weather, and all other acts of Providence. Those older in the game had taken me aside after that first month and pointed out that since I was the last teacher to join the faculty, I would naturally be the first to be dropped if attendance warranted a reduction in teacher allotment. I needed the job, so from then on the figures in my carefully-kept register stayed up in the high 90's, along with those of every other class. It looked pretty on the books!"

Since the proponents of governmentally controlled medicine often point to our public school system as a shining example of efficiency, it is not unfair to comment upon the effect of political control on the morale and integrity of teachers and school principals. Teachers admit that they have been forced to pad their registers; principals juggle daily attendance records to insure an adequate number of teachers; and Professor Fritz's payroll irregularities apparently are not considered unusual, since many teachers are defending him.

The above paragraph is not written to criticize the teachers in our public schools, but to remind our readers of the frailties of human nature. Doctors are as human as teachers. The New Zealand version of the Wagner-Murray-Dingell bill, since it was enacted into law, has cost many times over the estimate originally set—partly because, to the shame of the doctors, they have been padding their expense accounts just as our North Carolina school teachers are padding their attendance records.

May God preserve the doctors of North Carolina and of the United States from similar temptation.

THE PUBLIC EDUCATION SYSTEM*

For years the virtues of our system of public education have been extolled by those who favored "state medicine." "Look," said they, "consider how well it works, how equitably for all. It could be a model for a tax supported system of medical service. Everybody would be better served. Look at the noble school buildings, the excellent textbooks, the fine laboratories, the pension system, the compulsory education for everybody at everybody's expense."

Well, we have looked at it. Certainly the plant and structure is good. Textbooks are available. Athletic fields abound. Gymnasiums are provided. Sanitary facilities are of the best and usually well maintained. Bus service is available in rural and suburban areas generally. But what has happened to the teachers?

Daily we note that some are finding it necessary to take other jobs such as part-time bartending to supplement their miserable pittances as teachers; others are frankly quitting the profession.

Public indifference to their reasonable requests for more equitable salary levels is in many instances discouraging superior talent from consideration of teaching as a profession and forcing out discouraged personnel who find it impossible to maintain a decent standard of living and their own self-respect at present salary levels.

We hold no brief for commercialism in the professions. We have the greatest respect for the teaching profession. It has endured much; it deserves immediate rectification of gross salary inequalities before irreparable damage to its high quality and superior performance has been done.

We also take this occasion to point out again the inherent faults of government control and what inevitably happens thereunder where the professions are concerned. If the quality of teacher personnel and interest deteriorates, of what use are the buildings, the athletic fields, the good textbooks, the noble plumbing fixtures?

Under, for instance, national health insurance schemes, would we not face the same discouraging factors? More important even than what government control can do *for* you, is what it can do *to* you.

* Reprinted from Current Editorial Comment, New York State J. Med. 47:1770 (Aug. 15) 1947.

MEDICOLEGAL ABSTRACT

J. F. OWEN, M.D., LL.B.

RALEIGH

INSANE PERSONS: *The legal presumption is that all persons of mature age are sane. After they have been adjudged insane, however, the presumption is reversed until evidence is produced to show that they have become sane.*

This is an action in which a husband entered suit against his wife for an accounting of funds, for cancellation of a property settlement agreement, and for the cancellation and setting aside of a deed. From a decree of the circuit court dismissing the complaint, the husband appealed to the Supreme Court.

The plaintiff in this case had been adjudged insane by a county court on May 8, 1940, and committed to a mental institution. He had been to several other hospitals previously, but not under commitment. On July 26, 1940, he was found to be sane by the same court, and was discharged from the hospital on that date.

Shortly after the plaintiff was adjudged of unsound mind, his wife was appointed conservatrix of his property. Following the decree of the restoration of sanity, the wife was ordered to file an accounting; this she failed to do.

After the husband had been restored to his rights as a man of sound mind and memory, he and his wife decided to separate, and drew up a contract to that effect. Both signed the articles of separation and the property settlement. Later, the husband attempted to repudiate the contract, and notified his wife of this intention by letter. Eventually, he filed this suit to force the conservatrix to account for the property which came into her hands as a result of her official position, and to cancel the property agreement noted above.

The Supreme Court was of the opinion that a satisfactory accounting had been made by the conservatrix; that contrary to certain allegations of the appellant, there was no duress; and that, as the husband had been judicially declared sane, he was fully competent, in the absence of proof of insanity, to enter into an agreement. The husband, according to the records, suffered from paresis, and naturally there was some question, from a medical standpoint, as to his being fully restored. The condition had been present for several months, and no doubt had brought about very definite damage to the brain cells. The appellant's lawyers, depending upon the action of the Court and the history of the case, did not offer any evidence tending to show that he was of unsound mind at the time the agreement of separation was signed, although they were apparently depending upon insanity as a defense.

As was noted above, the action of the court in issuing a decree which restored the appellant to his rights, before the articles of separation were signed, had placed the appellant in his original position. The Supreme Court, in this connection, stated that a person of mature age is presumed to be sane and that unless the contrary was proved, the history in this particular case was of no significance in showing a lack of mental capacity to enter into an agreement.

The Supreme Court affirmed the action of the court below, and ruled that the separation agreement was legal and in force.

(Illinois Supreme Court, March, 1946. V. 66, N. E. Reporter, Second Series, p. 316.)

A final diagnosis of tuberculosis should never be made on the first x-ray film. A disturbing number of films showing definite infiltration of the lung field will be found to have cleared completely on a retake made two weeks later, and the parents will be spared much unnecessary worry and the radiologist no little embarrassment by this simple precaution. Students (and others) found to have significant lesions should be given a complete examination, including a tuberculin test and x-ray at once to determine the nature and activity of the process and the need of treatment. Those with inactive or suspicious lesions should be re-examined at least every six months to determine the questions of activity.—Alton S. Pope, M.D., NTA Bull., Nov., 1946.

The general hospital is in a unique position in tuberculosis control. Institutions in large cities, especially, can participate actively in such necessary contingent aspects of control as rehabilitation and the social and economic problems posed by this family and community disease. For highest effectiveness, hospital services for the tuberculous should be integrated with the public health programs in the city, town, or county. In every institution, the general practitioner must be an active participant in the radiography program. He provides the hospital with its patients, makes the final diagnosis, and treats those persons who are singled out by routine chest x-ray. Editorial, Pub. Health Rep., May 2, 1947.

TUBERCULOSIS ABSTRACTS

A Review for Physicians

Issued Monthly by the National Tuberculosis Association

Vol. XX November, 1947 No. 11

THE MOUNTING TOLL of heart diseases and cancer, which are primarily disorders of middle and late life, tends to foster too much complacency over the continuing reduction in the death rate due to tuberculosis. It is well to be reminded that death figures tell but one side of the story. To look behind mortality statistics and to consider their real meaning in terms of lives saved or ended prematurely is a salutary corrective to unwarranted optimism regarding tuberculosis.

TUBERCULOSIS DEATH RATE FAILS TO TELL THE ENTIRE STORY

The best available single index as to the status of tuberculosis control is and always has been the mortality rate from this disease. The success of the tuberculosis program is best measured by the steady decline in the death rate during the past several decades. It is an impressive fact that tuberculosis mortality in the country as a whole has declined 53 per cent between 1924 and 1944.

The drop in tuberculosis mortality varies widely in the sex and color groups. The greatest decline in the past 20 years, for example, has been registered in the death rate for white women among whom the drop was 67 per cent; among non-white men, on the other hand, tuberculosis mortality declined but 42 per cent during the same period. (According to the last Federal Census, 99.4 per cent of all non-whites in the United States were Negroes; hence the two groups are almost identical.)

Table 1 shows for each sex and color group the tuberculosis death rates in the past two decades, as well as the percentage decline in mortality.

Sex and color	Tuberculosis death rate 1944	1934	1924	Percent. decline in tuberc. death rate 1924-1944	1934-1944
All groups	41.3	56.7	87.9	53.0	27.2
White	33.7	46.2	74.9	55.0	27.1
Male	45.0	52.7	79.3	43.3	14.6
Female	23.3	39.6	70.4	66.9	41.2
Non-white	106.2	148.8	218.6	51.4	28.6
Male	122.7	156.9	215.0	42.1	21.8
Female	91.3	140.8	222.3	58.9	35.2

For no major cause of death has a mortality decline been recorded which compares favorably with the drop in the tuberculosis death rate. On the contrary, mortality from heart diseases, cancer, and certain other leading causes has increased rather steadily while that from tuberculosis has been dropping continuously.

Table 2 gives the 1944 death rates from these three major causes for each sex and color group.

Sex and color	Death rate per 100,000 population in 1944 Heart diseases	Cancer	Tuberculosis
All groups	315.4	129.1	41.3
White	310.1	128.8	33.7
Male	398.6	135.5	45.0
Female	254.2	133.3	23.3
Non-white	239.0	81.9	106.2
Male	274.3	75.6	122.7
Female	220.6	92.2	91.3

These death rates, though admittedly correct, tend to be misleading as to the relative importance of these three diseases. More of those who die of heart diseases and of cancer are elderly than is the case with those who die of tuberculosis. Moreover, tuberculosis is not only communicable but is preventable to an extent greater than either heart diseases or cancer.

A computation made to show the potential loss in years of life resulting from deaths from heart diseases, cancer, and tuberculosis in 1944 demonstrates vividly the seriousness of the disease which too often leads to prolonged illness and death in youth or middle age. This computation is based on the expectation of life at birth, as published by the Metropolitan Life Insurance Company in its Statistical Bulletin for May, 1946.

Separate analyses have been made for white and non-white men and women since these groups vary widely not only as to their expectation of life, but in the age distribution of deaths from certain causes.

The method used in this computation is simple indeed. For example, the average white woman may expect to live 69 years. If she dies at the age of 24 from tuberculosis, she has lost 45 potential years of life, whereas if she dies at 62 of heart disease, she has lost but seven potential years.

In the aggregate 1,929,953 potential years of life were lost by all Americans who died of heart diseases in 1944, compared with 1,287,245 potential years lost by those who died of cancer and 1,175,500 by those who died of tuberculosis in that year. In other words, because of the differences in the ages of those who died from these diseases, the potential loss in years of life occasioned by deaths from tuberculosis is within ten per cent of the loss caused by cancer, even though the tuberculosis death rate is but 32 per cent of the cancer death rate.

In spite of the fact that the mortality from heart diseases is seven and one-half times as high as that from tuberculosis, the potential years of life lost by those who died of heart diseases in 1944 were less than twice as numerous as the years lost by those who died of tuberculosis in the same year.

For many years the steadily declining tuberculosis death rate has been emphasized as the most significant evaluation of tuberculosis control. Less importance has been attached to a secondary result, namely, that not only are those who die of tuberculosis fewer in number each year but the median age at death becomes somewhat higher. These two encouraging developments have led some persons to the erroneous conclusion that tuberculosis is no longer a serious problem in this country. Yet, in spite of the declining death rate and the advance in the median age at death from tuberculosis, deaths from tuberculosis occur at much younger ages even today than do deaths from heart diseases and cancer.

It is clear from these findings that tuberculosis still constitutes one of our most serious social problems because of the comparative youth of the patients and decedents. Since all cases of tuberculosis are preventable, the disease also presents a more acute public health problem than do other major causes of death. Tuberculosis is unquestionably the most serious public health problem among non-white races; moreover, the gravity of this disease among white men has never been given proper consideration.

Decline in Tuberculosis Death Rate Fails to Tell the Entire Story, Mary Dempsey, The American Review of Tuberculosis, August, 1947.

BULLETIN BOARD

News Notes from the University of North Carolina School of Medicine

The School of Medicine and the Extension Division will resume this year postgraduate courses for physicians throughout the state. To date courses are scheduled at Lumberton and Salisbury beginning the middle of January, to be followed by courses at Greensboro and Raleigh and perhaps one or two other towns. Announcement of programs will be made in the next issue of the **Journal.**

News Notes from the University of North Carolina School of Public Health

The following staff members of the School of Public Health of the University of North Carolina attended the seventy-fifth annual meeting of the American Public Health Association at Atlantic City, New Jersey, October 6-10, 1947: Dr. E. G. McGavran, dean; Dr. John J. Wright, head of the Department of Public Health Administration; Dr. Lucy S. Morgan, head of the Department of Public Health Education; Professor Ruth W. Hay, head of the Department of Public Health Nursing; Miss Lake Allen, research assistant; Professor Paul D. Haney, Department of Sanitary Engineering; Professor Emil T. Chanlett, Department of Sanitary Engineering; Dr. Cecil G. Sheps, Department of Public Health Administration.

Dean E. G. McGavran will remain a member of the Executive Committee of the Governing Council of the APHA; he was made a member of the subcommittee on Field Training of the Professional Education Committee of the APHA, and was elected chairman of the Committee on Salaries for the Health Officers' Section of the APHA.

Dr. Lucy S. Morgan was placed on the Nominating Committee for the Governing Council Members of the Public Health Education Section of the APHA and will remain on the Advisory Board of the Cleveland Health Museum, the Section Council of the Health Education Section, the Governing Council of the APHA, and the Health Education Committee of the American Red Cross.

Professor Paul D. Haney was placed on the Nominating Committee for the Engineering Section and will remain on the Committee on Rural Sewerage Disposal of the Engineering Section.

* * * *

Dr. H. A. Morgan, director of the Tennessee Valley Authority, and Mr. W. M. Landess, head of the Agricultural Exposition Unit of the Tennessee Valley Authority, lectured to the School of Public Health at the University of North Carolina and North Carolina College (Durham) the week of October 13-16. The discussion was centered around the interdependence and interplay of basic factors, including laws which nature has set in motion, and man's recognition, understanding, and use of them, in determining our fundamental approach to achieving individual, national, and world security.

* * * *

Dr. Cecil G. Sheps, who was a visiting professor on the staff of the School of Public Health last summer, has been appointed associate professor of public health administration, School of Public Health, and assistant director of the epidemiology-syphilis study sponsored jointly by the Rockefeller Foundation and the North Carolina State Board of Health. Dr. Sheps received his M.D. degree from the University of Manitoba Medical School in 1936 and his M.P.H. at Yale University in June, 1947. Prior to coming to the University of North Carolina, he served as house surgeon in a general hospital in Stourbridge and London during the years 1937 and 1938; he conducted a private general practice in Winnipeg from 1939 until 1943; and from 1943 until 1946 he was school health physician for the City of Winnipeg Health Department.

* * * *

Miss Elta Mae Mast has joined the faculty of the School of Public Health as an assistant professor in public health education. Miss Mast was graduated from the Illinois State Normal University in 1942 with a B.S. degree; she received her M.S.P.H. from the School of Public Health of the University of North Carolina in 1945. From 1945 until her arrival at the University, Miss Mast was school health adviser with the Illinois State Department of Health, State Education Department in Springfield. Prior to this she held the position of biology teacher in the Normal, Illinois, public schools.

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Mrs. Ida H. Friday has been appointed assistant in public health education at the School of Public Health and director of the Health Education Workshop. Mrs. Friday received her A.B. degree from Meredith College and her M.P.H. degree from the School of Public Health of the University of North Carolina in June, 1947.

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Dr. Harold J. Magnuson, research professor of experimental medicine, has been presenting a paper, "The Development of Acquired Immunity in Experimental Syphilis," to Venereal Disease Seminars, held under the auspices of the U. S. Public Health Service, throughout the country. The September meeting was in Detroit, Michigan; the October meeting in Jackson, Mississippi; and the November meeting in Boise, Idaho. The work reported is part of the research program of the Reynolds Research Laboratory.

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Dr. Seymour P. Halbert, assistant professor of experimental medicine, has returned from a three months' field study at Letchworth Village, Thiells, New York. This field study was carried out as a part of the research work of the Reynolds Research Laboratory on antibiotic-producing strains of Escherichia coli.

CORRECTION

The Journal apologizes for an error which occurred on page 653 of the October issue, in the article, "Apoplexy of the Abdominal Wall," by Dr. T. C. Bost. The final paragraph on that page begins: "Tenderness and rigidity over the site of injury may be extreme. An indefinite mass is often seen and felt, and the area adjacent to the mass has a tenderness or rigidity." This last sentence should read as follows: "An indefinite mass is often seen and felt, and the area adjacent to the mass has NO tenderness or rigidity."

News Notes from the State Board of Health

While there were 77 more deaths in North Carolina reported to the State Board of Health during the first half of 1947 than in the corresponding period of 1946, there were, at the same time, 13,593 more births. The total number of deaths reported from January 1 through June 30 was 15,482, compared with 15,305 for the corresponding period of 1946, while the total number of recorded births was 57,176, as compared with 43,583 the first half of last year.

Deaths resulting from what are termed infant diseases totaled 1,345 during the first half of 1947, as compared with 993 during the corresponding period of 1946—an increase of 352, as compared with an increase of 77 in the number of deaths from all causes.

Of the grand total of 15,482 deaths reported to the North Carolina State Board of Health from January through June of this year, 8,196, or considerably more than one-half, were attributed to four causes: diseases of the heart, 3,779; intracranial vascular lesions, 1,736; nephritis, 1,390, and cancer, 1,291. There were, however, slightly fewer deaths from cancer this year than last, for the corresponding period.

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Rocky Mountain spotted fever is now more prevalent in North Carolina than typhoid fever, of which only 53 cases were reported among our nearly four million people last year, as compared with 66 cases of Rocky Mountain fever. Even typhus fever is now more prevalent than typhoid—and the menace of this disease will continue as long as we tolerate rats, whose population is increased by lax garbage collection and indifference on the part of householders who fail to protect the refuse they put out for the town or city to haul away.

North Carolina Neuropsychiatric Association

A meeting of the North Carolina Neuropsychiatric Association was held at the State Hospital at Butner on October 31. Guest speakers were Dr. T. A. Watters of the Tulane University Medical School, Dr. Howard R. Masters of the Medical College of Virginia, and Dr. Joseph A. Farmer of the Institute of Living, Hartford, Connecticut. North Carolina doctors taking part on the program were Drs. Richard L. Masland, Douglas M. Kelley, and E. O. Jeffreys of Winston-Salem, Drs. Leslie B. Hohman, Maurice H. Greenhill, and Hans Lowenbach of Durham, and Dr. R. G. Blackwelder of Raleigh.

Dr. R. Burke Suitt of Durham, vice president during 1947, was elected president for 1948, succeeding Dr. David Young of Raleigh. Dr. Lloyd Thompson of Winston-Salem was named vice president, and Dr. Frederick H. Hesser of Durham was re-elected secretary-treasurer.

Seventh District Medical Society

The following speakers appeared on the program of the Seventh District Medical Society meeting, held in Charlotte on November 5: Drs. James E. Hemphill and Tom W. Baker of Charlotte, Dr. Hugh H. Mills of Forest City, Dr. Frank Howard Richardson of Black Mountain, and Dr. D. E. Yow of Concord. Dr. Frank A. Sharpe of Greensboro, president of the State Medical Society, and Gus Travis, newspaper columnist of Charlotte, spoke at the banquet meeting.

Dr. J. A. Elliott of Charlotte, vice president of the society this year, was elected president for 1948, succeeding Dr. F. Y. Sorrell of Wadesboro. Dr. C. F. Glenn of Rutherfordton was elected vice president, and Dr. H. C. Thompson of Shelby was re-elected secretary. Dr. Elias Faison of Charlotte is councilor of the Seventh District. Rutherfordton was tentatively selected as next year's meeting place.

The doctors' wives were entertained during the afternoon meeting by the Mecklenburg County Auxiliary, and were guests at the banquet in the evening.

Eighth District Medical Society

The Eighth District Medical Society met in North Wilkesboro on October 30. The scientific program in the afternoon included papers by Drs. H. H. Bradshaw and George T. Harrell of Winston-Salem, Dr. Joseph B. Stevens of Greensboro, and Dr. John A. Ferrell, executive secretary of the North Carolina Medical Care Commission. Mr. John W. Clay of Winston-Salem was the speaker at the dinner meeting.

Officers elected for 1948 were Dr. Joseph B. Stevens of Greensboro, president; Dr. R. B. Davis of Greensboro, vice president, and Dr. M. D. Bonner of Jamestown, secretary-treasurer. Outgoing officers, all of North Wilkesboro, were Dr. Fred C. Hubbard, president; Dr. James H. McNeill, vice president, and Dr. William L. Bundy, secretary-treasurer. Dr. McNeill is also councilor of the Eighth District.

Edgecombe-Nash Counties Medical Society

At the October meeting of the Edgecombe-Nash Counties Medical Society, held in Rocky Mount on October 8, Mr. P. K. Gravely, chairman of Rocky Mount's Hospital Fact-Finding Committee, spoke on "Our Community's Present Hospital Status." The report of the blood bank committee was heard, and the following resolution adopted:

"RESOLVED: That a committee appointed by the president of the Society be authorized by the Society to attempt to accomplish the following:

"(a) Contact the civic clubs in the community and select one to actively sponsor a project to be known as the Community Blood Donor Service.

"(b) In cooperation with this group, work out a service making available whole blood from volunteer donors to patients at no cost to the patient for the blood except where specifically requested by the donor and recipient.

"(c) Contact the local chapter of The American Red Cross and make whatever arrangements they will to keep the lists of donors available at all hours and to all who may be in need of blood.

"(d) Contact the Rocky Mount Academy of Medicine and secure their cooperation in securing a panel of Negro donors. Assure this group that the Blood Donor Service is available to all persons.

"(e) Invite the cooperation of neighboring communities in obtaining panels of donors, which, when the occasion demanded, would be mutually available.

"(f) Act as an advisory group to provide whatever professional advice is necessary to the civic group actively sponsoring the project.

"(g) Report quarterly to the Society as to the status of the service."

President D. L. Knowles has appointed Dr. William Smethie to collaborate with the Business and Professional Women's Club concerning a cancer center in Rocky Mount. Drs. K. D. Weeks, M. L. Stone, and J. F. Crumpler have been appointed as the program committee.

Forsyth County Medical Society

Dr. W. Z. Bradford of Charlotte was guest speaker at the October meeting of the Forsyth County Medical Society, held in Winston-Salem on October 14. His subject was "Breech Presentation."

Halifax County Medical Society

Dr. W. C. Winn of the Medical College of Virginia spoke on "The Rh Factor in Obstetrics" at the regular monthly dinner and meeting of the Halifax County Medical Society, held in Roanoke Rapids on October 10.

News Notes

Dr. John M. Andrew, former fellow in radiology at the Cook County Hospital in Chicago, has announced the opening of offices for the practice of radiology in Lexington.

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Dr. Claude A. McNeill, Jr., has opened offices in Elkin for the practice of medicine. Dr. McNeill is a graduate of the Bowman Gray School of Medicine and, following his discharge from the army in October, 1946, took a postgraduate course in obstetrics and gynecology at the Baptist Hospital.

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Dr. Paul E. Simpson has announced the opening of offices for the practice of obstetrics and gynecology in Raleigh. Following his graduation from the Duke University School of Medicine, he spent five years in specialty training at Duke Hospital and two years on active duty with the U. S. Navy.

International College of Surgeons

The following doctors were among the 810 surgeons inducted into the United States Chapter of the International College of Surgeons, at the twelfth assembly and convocation, held in Chicago on October 3:

Fellows:

Dr. James G. Faulk, Monroe
Dr. Raymond L. Pittman, Fayetteville
Dr. Lance Truman Monroe, Concord

Associate:

Dr. Edward C. Jenkins, Pinehurst

Southern Psychiatric Association

Among the speakers at the meeting of the Southern Psychiatric Association, held in Birmingham, Alabama, October 13 and 14, were Drs. Leslie B. Hohman and Robert N. Creadick of Durham and Drs. Lloyd J. Thompson and Richard L. Masland of Winston-Salem.

Your Directory Information Card

Preparations are now being made to publish the new, eighteenth edition of the **American Medical Directory**! The last edition of the Directory was issued late in 1942. Since that time, it has been impossible to publish a new edition because of wartime restrictions and the shortage of paper and labor.

About November 15, a directory card will be mailed to every physician in the United States, its dependencies, and Canada, requesting information to be used in compiling the new directory. Physicians receiving an information card should fill it out and return it promptly whether or not any change has occurred in any of the points on which information is requested. It is urged that those physicians also fill out the right half of the card, which information will be used exclusively for statistical purposes. Even if a physician has sent in similar information recently, he should mail the card promptly to insure the accurate listing of his name and address. There is no charge for publishing the data nor are physicians obligated in any way.

The Directory is one of the most important contributions of the American Medical Association to the work of the medical profession in the United States. In it, as in no other published directory, one may find dependable data concerning physicians, hospitals, medical organizations and activities. It provides full information on medical schools, specialization in the fields of medical practice, memberships in special medical societies, tabulation of medical journals and libraries, and indeed, practically every important fact concerning the medical profession in which anyone might possibly be interested.

Therefore, should any physician fail to receive one of these Directory Information cards by December 1, he should write at once to the Directory Department requesting a duplicate card be mailed.

Review Courses Offered by the Tulane University School of Medicine

Short review courses on the following subjects are being offered this year by the Division of Graduate Medicine of the Tulane University School of Medicine, New Orleans:

Pediatrics—November 17-21
Electrocardiography—January 5-17
Gynecology—January 5-10
Obstetrics—January 12-17
Internal Medicine—January 19-31
General Surgery—March 15-20
Gastroenterology—March 1-6
Pediatrics—March 8-12

Detailed information will be furnished by the Director of the Division of Graduate Medicine, 1430 Tulane Avenue, New Orleans 13, Louisiana.

Atlanta Postgraduate Medical Assembly

The Fulton County Medical Society announces a three-day Postgraduate Assembly to be held in Atlanta January 28, 29 and 30, 1948, immediately following the Regional Meeting of the College of Surgeons. Because of the College of Surgeons meeting, surgical subjects will not be emphasized in this Assembly. The program has been arranged to help the average doctor keep abreast of the newer developments, but it is believed it will offer something of value to every man and woman practicing medicine in the Southeast.

The College of Surgeons invites all physicians in this region to their meeting, the expenses of which will be met by the College. The Postgraduate Assembly will have to require a registration fee.

The list of speakers is the best assurance of the excellence of the Assembly:

Dr. Lester Dragstedt, Professor of Surgery, University of Chicago

Dr. Chester S. Keefer, Professor of Medicine, Boston University

Dr. A. C. Ivy, Professor of Medicine, Northwestern University

Dr. Helen Taussig, Johns Hopkins University

Dr. Julius Lempert, New York City

Dr. Philip S. Hench, Mayo Clinic

Dr. E. von Hamm, Professor of Pathology, University of Ohio

Dr. Ralph M. Tovell, Hartford, Conn.

Dr. Robert Elman, Washington University, St. Louis

Dr. Tom D. Spies, Professor-Elect of Medicine, Northwestern University

Dr. Merrill C. Sosman, Clinical Professor of Roentgenology, Harvard Medical School

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Southeastern Allergy Association

The third annual meeting of the Southeastern Allergy Association will be held in Richmond, Virginia, on January 17 and 18 at the Jefferson Hotel.

Radiological Society of North America

More than 800 members of the Radiological Society of North America—medical specialists in x-ray and radium—are expected to attend the thirty-third annual meeting of the society at the Hotel Statler in Boston, November 30 to December 5, 1947.

Urology Award

The American Urological Association offers an annual award of $1000.00 (first prize of $500.00, second prize $300.00 and third prize $200.00) for essays on the result of some clinical or laboratory research in urology. Competition shall be limited to urologists who have been in such specific practice for not more than five years and to residents in urology in recognized hospitals.

The first prize essay will appear on the program of the forthcoming meeting of the American Urological Association, to be held at the Hotel Statler, Boston, Massachusetts, May 17-20, 1948.

For full particulars write the secretary, Dr. Thomas D. Moore, 899 Madison Avenue, Memphis, Tennessee. Essays must be in his hands before March 1, 1948.

National Gastroenterological Association 1948 Award Contest

The National Gastroenterological Association again takes pleasure in announcing its Annual Cash Prize Award Contest for 1948. One hundred dollars and a Certificate of Merit will be given for the best unpublished contribution on gastroenterology or allied subjects. Certificates will also be awarded those physicians whose contributions are deemed worthy.

Contestants residing in the United States must be members of the American Medical Association. Those residing in foreign countries must be members of a similar organization in their own country. The winning contribution will be selected by a board of impartial judges and the award is to be made at the Annual Convention Banquet of the National Gastroenterological Association in June of 1948.

Certificates awarded to other physicians will be mailed to them. The decision of the judges will be final. The Association reserves the exclusive right of publishing the winning contribution, and those receiving certificates of merit, in its official publication, **Review of Gastroenterology.**

All entries for the 1948 prize should be limited to 5,000 words, be typewritten in English, prepared in manuscript form, submitted in five copies, accompanied by an entry letter, and must be received not later than April 1, 1948. Entries should be addressed to the National Gastroenterological Association, 1819 Broadway, New York 23, N. Y.

Pan-American Congress of Ophthalmology

Plans have been announced for the Third Pan-American Congress of Ophthalmology, which is to be held in Havana, Cuba, January 4 to 10, 1948. It is anticipated that about 1,000 eye specialists will attend the sessions at the University of Havana School of Medicine.

A program of more than forty formal papers has been arranged, with speakers divided about equally between physicians of the northern half of the hemisphere and those of the Latin American countries. Papers presented by English-speaking ophthalmologists are to be discussed by their colleagues who speak Spanish, Portuguese or French, and the papers in the Latin languages will be discussed by members of the English-speaking contingent. During the presentation of each paper, slides bearing resumes of one other language will be shown, in order to facilitate understanding by those who are unfamiliar with the language used by the speaker.

In addition to the contributions by members, there will be several by specially invited guests, including Sir Stewart Duke-Elder of London, Dr. Elizabeth Cass of Gibraltar, Prof. A. Fuchs, a renowned Viennese ophthalmologist now living in Shanghai, and Dr. Hermenegildo Arruga of Barcelona, Spain. Dr. Derrick T. Vail, professor of ophthalmology, Northwestern University Medical School, Chicago, will deliver the Harry Gradle Lecture in honor of the founder and first president of the congress.

Besides the formal addresses, a series of instructional courses has been planned for the congress, following the plan successfully used for many years by the American Academy of Ophthalmology and Otolaryngology. There will be thirty courses in English, five in Portuguese, and fifteen in Spanish, presented in the mornings of January 6, 7, and 8.

(BULLETIN BOARD CONTINUED ON PAGE 749)

AUXILIARY

Are doctors' wives sufficiently aware of some of the more general conditions affecting the medical profession? There are some vital things being brought to the attention of the public through various sources about which they should be well informed.

As an example, not long ago a lady was defending socialized medicine because she felt it was the only method which would provide medical care for the masses. She had not heard of prepaid medical care such as that offered by the Hospital Saving Association of North Carolina at a cost which the lowest-salaried worker can afford—a plan for *voluntary* rather than *government-controlled* medical care for the masses. She was quite impressed when she was told about it. Not nearly enough people know about the Blue Cross plan for prepayment of medical care, even though statistics show that this state ranks seventh in the nation in the number participating in its benefits. Every doctor's wife should be able to present this plan intelligently. For this reason your program committee is urging you to study the plan so that you will be familiar with it.

Another phase of the program suggests that we all be informed about the contents of the health bill which was passed by the 1947 legislature, as well as other bills which would aid the profession and its interests as a whole. An editorial in the *Greensboro Daily News* for October 7 calls attention to the fact that the loan fund established for medical students two years ago has been used very little. In fact, according to the *Asheville Citizen,* only one loan has been made. The *News* raises the question as to why this fund has not been used in this state to the same extent that it has in Mississippi, where there is a similar law. Isn't it possible that not enough students know about it? Perhaps we could bring it to the attention of groups in which we are active. Its use no doubt would help in some degree to solve the need for doctors in rural areas, and there are in all probability some young men who would study medicine if they knew that this help is available. Mississippi gave it a great deal of publicity.

Then there is the shortage of nurses! We hear it from doctors, patients, their relatives, and interested friends. In *The State* magazine for October 4, Carol Dare mentions it on her page, "Merely a Woman's Opinion." The scholarship of $400 to $500 mentioned by Miss Virginia Miles, Counselor of the State Nurses Association, for some worthy student nurse is a worthwhile project for any auxiliary or civic club.

Some of you by now have met Miss Alice Geraldine Maxwell, "Miss North Carolina Student Nurse of 1947." I am sure you have found her charming, as will the high school girls when they hear her talk and meet her at the teas which are being given in her honor by the medical auxiliaries in the cities where she is making her appearances. The doctors' wives of these communities will have a wonderful opportunity to follow up interest which she arouses, and perhaps see that a scholarship is provided if some suitable student is interested but feels she cannot afford to enroll as a student nurse.

If Auxiliary members will reserve a little of their reading time for studying some of these pertinent problems, they will certainly see the many needs and they will become *informed* and therefore better able to carry the necessary information to groups with which they are associated. If those of you who are interested enough to read this page, as well as *The Bulletin* and other magazines on matters of medical interest, will attempt to create interest in others, it will help to spread the needed information.

Last, but far from least, let us not forget the social side. We all know that a doctor's duties allow him to spend all too little time with his family. Could we be just a little selfish about this one interest, and foster, to the utmost, family activities, as well as associations with friends and groups in our communities? Our husbands need us. Their families and friends need them.

And so let the program for the year unfold—with Auxiliary members filling their places as informed members of their communities and being the hub around which the wheel of family life is built, as well as the rim which holds its many spokes together.

MRS. HARRY L. JOHNSON,
Elkin
Chairman of the Program
Committee.

BOOK REVIEWS

Clinical Methods of Neuro-Ophthalmologic Examination. By Alfred Kestenbaum, M.D., 384 pages. Price, $6.75. New York: Grune and Stratton, 1946.

This book will be a very valuable reference for neurologists and neurosurgeons. Although the book begins with a chapter on "Anatomy of the Optic Pathway," the author takes extensive basic knowledge for granted. This limits the book's usefulness somewhat for the physician not familiar with detailed ocular physiology and inexperienced in methods of neurologic ocular examination.

The extensive information presented is well organized. There is a useful glossary and index. The bibliography is lengthy, but most of the references are in German and all but two are to works published prior to 1942.

This book has been written with such a rare economy of words that virtually every sentence conveys information. This condensation makes reading slow but learning fast. Authors of many medical texts would do well to study Kestenbaum's style.

Essentials of Pharmacology. By Frances K. Oldham, M.Sc., Ph.D., Research Associate in Pharmacology, The University of Chicago; F. E. Kelsey, Ph.D., Associate Professor of Pharmacology, The University of Chicago; and E. M. K. Geiling, Ph.D., M.D., Frank P. Hixon Distinguished Service Professor and Chairman of the Department of Pharmacology, The University of Chicago. 440 pages. Price, $5.00. Philadelphia: J. B. Lippincott Company, 1947.

The University of Chicago pharmacologists have produced an excellent concise survey of pharmacology. The book is modern, covering the new antihistamine drugs, the antibiotics, pteroylglutamic acid, nitrogen mustards, radioactive phosphorus, dolophine, and many other new preparations. The well organized bibliographies are unusual for a textbook in that the references are very recent, many of them being from 1947 publications.

In compiling a short book it is always difficult to know where to abbreviate. The authors wisely included little material on therapeutics, which occupies a small place in an introduction to pharmacology. It appears to this reviewer that the discussions of the cardiac glycosides, antacids, and cathartics are a bit brief. In general, however, the condensation of material has been very well handled, and the brevity—an invaluable attribute in a textbook—more than compensates for these minor criticisms.

The book has been printed on rough paper in large type—a pleasant change from the slick paper and small type all too commonly used in medical textbooks.

A New Test for the Detection of Color Blindness. By P. B. Wiltberger, M.D. 19 pages. Price, $4.00. Columbus, Ohio: Long's College Book Company, 1945.

This monograph offers a different and perhaps more physiologic method of determining color blindness than has heretofore been available. It is based on the "after-image" phenomenon for colors, and is performed by matching color chips with the after-images formed after gazing at other color chips. Thus no knowledge of colors is required, and it is practically impossible to memorize the test. Its greatest value is in distinguishing true color blindness—and especially red-green blindness—from color weakness, since a person who is blind for any color will see no colored after-image after gazing at that color. Color weakness is evaluated probably less accurately by the time required for the colored after-image to be formed.

The highly physiologic nature of the test commends it, but its chief disadvantage would seem to be the greater time required for its performance and the greater difficulty in getting across to the patient what is desired of him in the test. It is felt that these factors will make tests of the nature of the Ishihara charts still the more useful for routine testing. Where extreme accuracy is needed, however, this test is a fine adjunct.

A shorter form of the test, sold by the same publishers for $1.00, appears ample to meet most testing needs.

Epilepsy; Psychiatric Aspects of Convulsive Disorders. The Proceedings of the Thirty-Sixth Annual Meeting of the American Psychopathological Association. Edited by Paul H. Hoch, M.D., New York State Psychiatric Institute, and Robert P. Knight, M.D., The Meninger Clinic, Topeka, Kansas. 214 pages. Price, $4.00. New York: Grune & Stratton, 1947.

This book includes contributions by twenty-one different authors and deals with a number of different aspects of the convulsive disorders. It includes sections on the history of epilepsy, the principles of drug treatment and of psychiatric treatment, the incidence of epilepsy, the results of Rorschach and other mental tests in the convulsive states, the psychopathologic aspects of epilepsy, exerimentally produced convulsions in animals, and the electroencephalogram in epilepsy.

The book has several characteristics inevitable in any symposium of this sort. The work is uneven, the quality of each chapter depending on the ability of the contributor. In addition, the book tends to be spotty in its coverage, dealing with certain narrow aspects of the convulsive disorders as seen from the particular viewpoints of certain individuals. The section on "Social Implications and Management," for example, deals chiefly with desirable changes in our institutional care of epileptic patients, and only briefly discusses the many problems faced by the general practitioner who is forced to treat the epileptic patient in the community.

The chapter on "The Personality of the Epileptic" deals almost exclusively with the results of Rorschach study, which again is of little value in aiding in an over-all understanding of the individual. The chapter on "Psychopathology of Epilepsy" is an analytic interpretation of epileptic reactions, which appears to be quite narrow in its outlook.

As a collection of papers dealing with important recent research relating to the convulsive disorders, this book is extremely stimulating to the physician especially interested in the convulsive states. The book could fill a desirable position in emphasizing the importance of mental disturbances in patients suffering with convulsive disorders, but it is to be feared that the coverage of this particular part of the problem is not adequate to provide any practical aid in actually dealing with such patients. For this reason, its value to the general practitioner interested in a broad understanding of the psychiatric aspects of convulsive disorders will be limited.

BULLETIN BOARD

(CONTINUED FROM PAGE 746)

HUMAN BETTERMENT LEAGUE OF NORTH CAROLINA

The following questionnaire on sterilization is being distributed by the Human Betterment League of North Carolina. Copies may be obtained by writing to the Human Betterment League of North Carolina, P. O. Box 3036, Winston-Salem, N. C.

What Do You Know About Sterilization? North Carolina Is One of the Progressive States With Laws Providing for the Sterilization of the Mentally Unfit

Test your knowledge of this important health and social measure.

1. Is it possible for a sterilized man or woman to lead a normal sex life?
2. Is every case of insanity and feeblemindedness reported for sterilization to the North Carolina Eugenics Board carefully investigated before the operation is performed?
3. Will the state sometimes permit an insane or feebleminded person to adopt a child?
4. If a child does not inherit the mental defect of his parent can he be harmed by the parent's mental affliction?
5. Are over half of the hospital beds in North Carolina occupied by mental patients?
6. Did North Carolina's men receive a high rating for sound mental health during Selective Service examinations for the armed forces?
7. Can some types of insanity now be cured?
8. Are new cures being found for feeblemindedness?
9. Do feebleminded persons have few children because they are less fertile than normal ones?
10. Is sterilization usually done against the wishes of the patient or of the patient's family?

Here Is the Truth about Sterilization and North Carolina's Laws Concerning It

1. **YES.** A sterilized man or woman can lead a completely normal, satisfying sex life because **sterilization removes nothing from the body.** The simple operation merely closes the tiny passages through which the life-producing cells must travel. The cells are absorbed by the body and the functioning of the sex organs is not affected in any way.
2. **YES.** North Carolina statutes provide special legal safeguards to prevent any abuse of this important law. A careful investigation is made by the North Carolina Eugenics Board of every case recommended by the heads of certain institutions, or by county superintendents of welfare. If the Board finds that sterilization is indicated it can order the operation performed at public expense.
3. **NO.** Placing a helpless child in the care of mentally unbalanced or deficient persons would be grossly unfair and could result in tragedy. No conscientious judge would permit a person suffering from mental illness or deficiency to adopt a child. It is equally tragic and unfair to permit children to be born to such parents, exposed to the double risk of questionable heredity and bad environment.
4. **YES.** It is possible for insane or feebleminded parents to give birth to mentally normal children, but such children are often psychologically affected for life by their home surroundings. Children reared by mentally deficient parents start life with an environmental handicap from which they may never recover.
5. **YES.** Mental cases occupy more than one-half of all the hospital beds in the State at an annual cost to the tax-payers of about $2,000,000. There are more persons in hospitals (2811 at the last report) suffering from the type of insanity known as schizophrenia (dementia praecox) than any other single disease! If insanity is permanent, sterilization can be extremely valuable in protecting its victims from undesirable parenthood.
6. **NO.** Selective Service rejections because of mental disease or deficiency were high throughout the war. In 1942 they accounted for 14% and during 1944 for 48% of the North Carolina men found unfit for military service.
7. **YES.** Insanity is mental illness, which frequently attacks persons who were entirely normal at birth. Medical science is learning more about ways to cure **some types** of insanity.
8. **NO. Feeblemindedness is not a disease** and therefore cannot be cured. Feebleminded patients are born with defective mental equipment which cannot be changed any more than the color of their eyes can be altered. With proper training some individuals can be taught to be reasonably self-reliant. They may even be self-supporting after marriage if protected from the responsibility and cost of rearing a family. Feebleminded girls are particularly in need of the protection of sterilization since they cannot be expected to assume adequate moral or social responsibility for their actions.
9. **NO.** Persons of low mentality are not less fertile than normally intelligent persons. Idiots and imbeciles seldom have either sexual or reproductive power, but morons, who far outnumber all other groups of mental defectives, are **doubling their number** with each generation.
10. **NO.** If the patient or his family feel that the operation should not be performed, **appeal to the courts is possible.** However, in almost all cases the operation is welcomed when it is understood that there will be **no detectable physical or mental change** except that children will not be produced.

A study made at the Alabama State School for the Feeblemindeed in 1945 showed that out of 1429 patients, 553 had been born of feebleminded parents, and another 87 patients had had at least one parent hospitalized for insanity.

Was anything gained by the birth of these 640 children doomed from the start to empty, meaningless life in an institution for mental defectives?

The National Resources Committee reporting on the alarming increase of mentally deficient and handicapped persons in this country, stated:

> "The proportion of persons handicapped by hereditary deficiencies might be reduced by intelligent social action . . . It seems clear that the prevention of reproduction by persons handicapped by severe mental deficiency or by disabling physical conditions, that appear to be hereditary, is socially desirable."

North Carolina is a leader among the progressive states which have provided the legal framework for such desirable social action.

We have the law! It is up to every North Carolinian to understand that law and support it!

Medical Women's Library Committee

November 7 has been designated as Blackwell Day, in honor of Elizabeth Blackwell, the first woman in the world to receive an M.D. degree. The Medical Women's Library Committee of the American Medical Women's Association is observing this day by requesting donations to the Medical Women's Library, Woman's Medical College, Philadelphia, Pennsylvania. The donations should be in the form of one or more books by or about women in science, or checks to be used for the purchase and collection of such books.

Motion Picture Films

To assure the listing of all outstanding medical and surgical motion picture films in the revised "Catalogue of Professional Motion Picture Films" now being compiled, all film authors are urgently requested to write immediately for film questionnaires to be filled out and returned. All members of the profession are invited to cooperate with this undertaking by forwarding this announcement to an author or by furnishing the film title and full name and address of any film author. Send information to: Academy-International of Medicine, 214 West Sixth Street, Topeka, Kansas.

News Notes from the Surgeon General's Office

Army Personnel to Receive 'Flu' Vaccine

Vaccination of all military personnel against influenza will begin during October, and those entering the service prior to April 1, 1948, will receive influenza vaccine along with their initial immunizations. Precautions will be taken to avoid administering influenza vaccine to persons having a history of egg allergy. In addition to the A and B viruses the vaccine contains an A-variant cultured from the distinctive type of influenza that occurred at Fort Monmouth, N. J., last season. Inasmuch as a new strain was isolated last year, it is possible that other new strains may be demonstrated this year. The Army is on a lookout for any new strains that may occur.

Veterans Administration

Appointment of Dr. Arden Freer of Washington, D. C. as deputy medical director of Veterans Administration was announced recently by Dr. Paul R. Hawley, VA's chief medical director. Dr. Freer succeeds Dr. Robert C. Cook, who requested transfer to Colorado, where he will be manager of the VA hospital at Fort Logan. Dr. Roy A. Wolford, assistant chief of VA's Tuberculosis Service, has been named acting executive officer of professional services, pending permanent appointment of a successor to Dr. Freer.

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Dr. Donald A. Covalt, chief of Veterans Administration physical medicine rehabilitation service, has resigned, effective November 15, to become associate professor of physical medicine and rehabilitation in the New York University School of Medicine and also head of NYU's new Rehabilitation Institute. Dr. A. Ray Dawson, for the past year and a half head of the physical medicine rehabilitation service in the Richmond, Va., Branch Office of VA, has been named to succeed Dr. Covalt.

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Appointment of Dr. Paul B. Magnuson, former professor of surgery and chairman of the Department of Bone and Joint Surgery at Northwestern University Medical School, Chicago, as acting chief of Veterans Administration Professional Services, was announced recently by VA. Dr. Edward Harvey Cushing, former associate clinical professor of medicine at Western Reserve University, Cleveland, O., will succeed Dr. Magnuson as chief of the Research and Education Service.

Eighty Years of Marriage and Divorce Statistics in the United States

Six times as many marriages took place in the United States in 1946 as in 1867, and 60 times as many divorces occurred in 1946 as in 1867, according to figures covering the 80-year period contained in a report released recently by the National Office of Vital Statistics, Public Health Service, Federal Security Agency.

Smith, Kline & French Laboratories of Philadelphia, pharmaceutical manufacturers, announce the appointment of Maurice L. Moore, Ph.D., as director of research laboratories, succeeding the late Dr. Walter G. Karr. Dr. Moore comes to SKF from Frederick Stearns & Company, where he was assistant director of research.

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